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ABSTRACT

This guide is designed to provide summary information about assistance programs of the National Science Foundation, and is intended as a source of general guidance for institutions and individuals interested in participating in these programs. Program listings describe the principal characteristics and basic purpose of each activity, eligibility requirements, closing dates (where applicable), and the address from which more detailed information, brochures, or application forms may be obtained. (Author)

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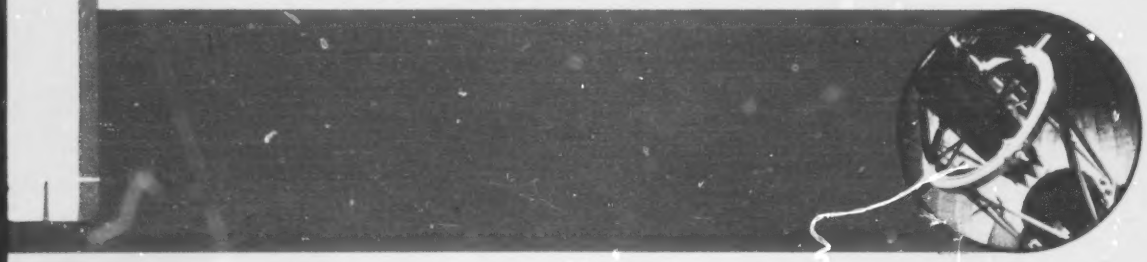
Guide to Programs

National Science Foundation



FISCAL YEAR 1974

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ED 090051

Guide to Programs

National Science Foundation

FISCAL YEAR 1974

INTRODUCTION

The National Science Foundation is an agency of the Federal Government established in 1950 to advance scientific progress in the United States. The Foundation fulfills this responsibility primarily by sponsoring scientific research, encouraging and supporting improvements in science education, and fostering scientific information exchange. NSF does not itself conduct research or carry out education projects.

The Foundation supports scientific research and education projects in the mathematical, physical, medical, biological, social, and engineering sciences. The Foundation does not support projects in clinical medicine, the arts and humanities, business areas, or social work.

The National Science Board is the policymaking body of the National Science Foundation. It consists of 25 members appointed by the President, by and with the consent of the Senate, and includes the Director of the Foundation who serves on a full-time basis. The Board passes on new Foundation programs and on grants or contracts requiring a total commitment of more than $2 million or an annual expenditure of more than $500,000.

Proposals for support are ordinarily assigned to the appropriate division or office for review and evaluation. An organization chart depicting the major areas of program activity is provided on page 85.

In making its decisions on proposals, the Foundation relies heavily on the advice and assistance of advisory panels, outside reviewers, and other experts to ensure that NSF is able to reach fair and knowledgeable judgments. These scientists and educators come from colleges and universities, from nonprofit research and educational organizations, from industry, and from other Government agencies. Their counsel has proven invaluable to the Foundation.

The National Science Foundation Act of 1950, as amended, permits the Foundation to support basic research, without restriction as to the type of performer. It also permits the support of applied research at academic and other nonprofit institutions. By letter to the Director of April 13, 1972, and pursuant to the authority of Section 3(c) of the Act, the President extended the applied research authority in the following terms:

> The Foundation, in making grants or contracts for applied scientific research relevant to national problems involving the public interest, may support such work at other than academic and nonprofit institutions when the Director of the National Science Foundation determines that it would be advantageous to use the capabilities of such other institutions to accomplish the program objectives.

Within the limits of this Directive, it is the policy of the National Science Foundation to support research at

industrial or commercial organizations when it is advantageous for the attainment of its program objectives. The Director of the Foundation has determined in which research program areas industrial and commercial organizations will be encouraged to participate, and has approved the criteria for participation in the program.

The Foundation will continue to emphasize its traditional role of support for a strong national basic research capability, particularly in academic institutions, and the improvement of science education. At the same time, the participation of individual industry and other nonacademic organizations is encouraged in the following NSF program areas:

1. RANN (Research Applied to National Needs)
2. Experimental R&D Incentives Program
3. National R&D Assessment Program
4. International Decade of Ocean Exploration Program
5. Computer Applications in Research Programs
6. Computer Impact on Society Program
7. Science Information Service

Also, collaboration between industry and university researchers, as well as between industry and State or local governments, on appropriate programs is encouraged. Similarly, broader efforts through industry associations, groups of companies, or professional societies may be supported. Prospective proposers are encouraged to contact the appropriate program for program announcements and brochures and for preliminary discussions and guidance prior to the submission of a proposal.

Generally, awards are made in response to both solicited and unsolicited proposals. Normally, awards resulting from unsolicited research proposals are made on a cost-sharing or jointly funded basis while those from solicited proposals may provide for payment of full costs including fee. Proposals in response to specific program announcements are considered solicited only when the announcement so indicates.

Disposition of rights to data and inventions resulting from Government-supported research are subject to negotiation. Factors to be considered are the nature and purpose of the project and other factors involving the public interest, the commercial position of the awardee, and any equities he may have. At a minimum the Government will receive a royalty-free, paid-up license and the right to require the licensing of others on reasonable terms in certain circumstances.

The National Science Foundation looks forward to being able to utilize and properly integrate the capabilities of all institutions in the support of science and its contribution to society and the Nation.

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I. SCIENTIFIC RESEARCH PROJECT SUPPORT

The National Science Foundation provides comprehensive support to research in all the sciences. Major mechanisms through which research is supported include project grants for the work of scientists, primarily at universities and colleges and cooperative national research programs of a specialized nature. In addition, the Foundation assists in the procurement of specialized research facilities and equipment.

The Foundation considers all proposals for the support of research projects, regardless of source. The majority of such requests are submitted by U.S. universities and colleges on behalf of individual scientists or groups of scientists on their faculties. Foundation policy is to emphasize research that contributes to graduate and postdoctoral education in the sciences. Support of research at foreign institutions is provided only when it is clearly in the interest of science in the United States.

Research project proposals are considered primarily on the basis of scientific merit. Scientific merit is assessed according to the promise of significant scientific results, the possible scientific impact, the probable opening of a new field, the educational byproducts, and potential applications.

Programs described in chapter I are administered by the office of the Assistant Director for Research. Other programs administered by this directorate will be found in chapter II, National and Special Research Programs.

Scientific Research Projects

THE NATIONAL SCIENCE FOUNDATION awards grants to support research in science, engineering, and mathematics. On rare occasions research support may take the form of a contract rather than a grant; proposals directed at grants or contracts are prepared in an identical manner.

A research project grant may support either a specific research project or research in a coherent area of science.

Research support is given to the full spectrum of sciences, including:

Biological & Medical Sciences
(excludes clinical aspects)
cellular biology; ecology; evolutionary and systematic biology; molecular biology; physiological processes; psychobiology and neurobiology.

Engineering
chemical processes; heat transfer; plasma dynamics and nuclear engineering; thermodynamics and mass transfer; civil and environmental technology; fluid mechanics; industrial technology; solid mechanics; control and automation; devices and waves; electrical and optical communications; systems theory and applications.

Mathematical & Physical Sciences
astronomy; chemistry; mathematics; physics.

Materials Research
physics and chemistry of solids and liquids; polymer science; materials engineering.

Social Sciences
anthropology; economic and social geography; economics; history and philosophy of science; law and social sciences; linguistics; political science; science policy; social psychology; sociology; and social indicators.

Environmental Sciences
atmospheric sciences; earth sciences; physical and biological oceanography.

Proposals do not have to fit uniquely into any one of the above science areas.

Institutions are required to share in the cost of each unsolicited research project supported by an NSF grant or contract. Before submitting a proposal for research support the brochure GRANTS FOR SCIENTIFIC RESEARCH should be consulted. The Foundation does not require standard application forms for research proposals.

Grants normally provide support for periods up to 24 months. Projects of high scientific merit may be approved scientifically for periods up to 60 months and will be funded on an annual basis for the term of the approval, contingent upon the availability of funds and the scientific progress of the research.

Eligibility

Proposals may be submitted by U.S. colleges and universities and by academically related nonprofit research organizations. The conditions under which support is occasionally provided to other types of organizations and to individuals is described in the NSF brochure GRANTS FOR SCIENTIFIC RESEARCH, available from the address below. Inquiry may also be made directly to the Assistant Director for Research.

Industrial organizations are infrequent recipients of awards from the Scientific Research Project Support Program. Industry proposals for basic research will, however, be considered in exceptional cases where: (a) the project is of special concern from a national point of view and shows promise of solving an important scientific problem; (b) unique resources are available in industry for the work; or (c) the project proposed is outstandingly meritorious.

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Deadlines

Proposals may be submitted at any time. Approximately 6 months should be allowed for the consideration of a proposal.

Additional Information

Communications may be addressed to the appropriate division: Division of Biological and Medical Sciences, Division of Engineering, Division of Environmental Sciences, Division of Mathematical and Physical Sciences, Division of Materials Research, or Division of Social Sciences; National Science Foundation, Washington, D.C. 20550.

Engineering Research Initiation Grants

THE NATIONAL SCIENCE FOUNDATION awards grants to encourage the development of meritorious and innovative research programs by engineering faculty members.

Two options are available to a prospective grantee:

Option A—provides research support for an investigator for a period of 18 months covering a summer and the following academic year and summer.

Option B—provides support for combining a research program with industrial experience. Under this option, it is expected that the investigator will devote at least one-fourth time during the academic year to research, and will spend 2 months of each summer preceding and following the academic year in a nonacademic environment directly related to the research activities. Additional support is provided to cover the costs associated with relocation during the two summers.

Eligibility

A proposal may be submitted on behalf of an individual who:

(1) Is an assistant professor, instructor (or equivalent level) holding a full-time regular academic appointment on the engineering faculty of an institution of higher education within the United States that confers graduate degrees in engineering;

(2) Is a citizen or permanent resident of the United States as of date of submission of proposal; and

(3) Has had no substantial support.

Deadlines

Instructions for preparing engineering research initiation proposals are available in early October from the offices listed below. Request the ENGINEERING RESEARCH INITIATION GRANTS brochure. Proposals must be postmarked on or before the first Monday in December to be eligible for consideration.

Additional Information

Communications may be addressed to: Division of Engineering or Division of Materials Research, National Science Foundation, Washington, D.C. 20550.

Doctoral Dissertation Research

THE NATIONAL SCIENCE FOUNDATION awards grants to improve the scientific quality of dissertations in the social sciences and certain sciences involving extensive field work. Grants are awarded for periods up to 24 months. Grant funds may not be used as a stipend for the doctoral candidate, although he may receive support from other sources.

Eligibility

Proposals may be submitted by universities on behalf of doctoral candidates for the support of dissertation research in systematic biology, ecology, and ethology (biological and medical sciences); oceanography, earth sciences, and atmospheric sciences (environmental sciences); and the social sciences, including science policy and problems of poverty. Proposals should be submitted by the dissertation advisor, department chairman, or chairman of the departmental committee on doctoral degrees.

Deadlines

Proposals may be submitted at any time; one or more grant requests may be made in a single proposal if the budget for each request is set forth separately. Four months should be allowed for processing the grant application.

Additional Information

A leaflet that sets forth application procedures is available from the Foundation. Communications may be addressed to: Division of Biological and Medical Sciences, Division of Environmental Sciences, or Division of Social Sciences, National Science Foundation, Washington, D.C. 20550.

Specialized Research Facilities and Equipment

THE NATIONAL SCIENCE FOUNDATION awards grants for specialized research facilities and major items of research equipment within the regular research competition.

Facilities supported under this program are those required for highly specialized scientific purposes, as distinct from laboratory buildings used in normal academic research programs. Examples are: controlled-environment biological laboratories, some marine research equipment and support facilities, mobile laboratories, off-campus research facilities, and unique one-of-a-kind research facilities. Grants may provide for construction or modernization of facilities.

Equipment support may be provided where a research tool is needed by several investigators in a department. Examples are: electron microscopes, mass spectrometers, cryogenic equipment, and special-purpose computers.

The National Science Foundation encourages local contributions from non-Federal funds whenever possible; however, there is no fixed requirement as to the amount of funds that institutions must contribute.

Before submitting a proposal for specialized research facilities and equipment the NSF brochure GRANTS FOR SCIENTIFIC RESEARCH should be consulted. The Foundation does not provide standard application forms for research facilities and equipment proposals.

Eligibility

Institutions eligible to submit proposals are colleges and universities offering graduate studies (though in exceptional circumstances colleges and universities without graduate programs may be eligible), associations of colleges and universities, and nonprofit research institutions such as research museums.

Deadlines

Proposals may be submitted at any time. Approximately 4 to 6 months are required for consideration of a proposal.

Additional Information

See also page 17, Oceanographic Facilities and Support.

The NSF brochure GRANTS FOR SCIENTIFIC RESEARCH is available from the Foundation. Communications may be addressed to the appropriate division: Division of Biological and Medical Sciences, Division of Engineering, Division of Environmental Sciences, Division of Mathematical and Physical Sciences, Division of Social Sciences, or Division of Materials Research, National Science Foundation, Washington, D.C. 20550.

II. NATIONAL AND SPECIAL RESEARCH PROGRAMS

National and Special Research Programs of the Foundation are major efforts of research or research support of such broad scope that extensive coordination of planning, management, funding, and logistics is essential to effective program performance. These programs may be characterized by inclusion of one or more of the following elements: international cooperation, coordination with other agencies of Government, a relationship to a specific geographic region, or interdisciplinary scientific investigations.

Except where otherwise noted, programs described in this chapter are administered by the Assistant Director for National and International Programs.

International Biological Program

THE NATIONAL SCIENCE FOUNDATION awards grants to support research projects that are part of the U.S. participation in the International Biological Program (IBP). The theme of IBP is the study of "the biological basis of productivity and human welfare," and the major portion of the program is in the area of ecosystem analysis.

The International Biological Program was proposed by the International Council of Scientific Unions in 1964; there are 55 nations now participating in the program. The U.S. National Committee for the International Biological Program, established by the National Academy of Sciences-National Research Council, assists in planning U.S. participation in IBP.

Eligibility

Since the International Biological Program terminates at the end of fiscal year 1974, proposals to initiate new research cannot be considered. Support will be limited to that required for completion and synthesis of results from current activities.

Additional Information

Communications may be addressed to: Division of Biological and Medical Sciences, National Science Foundation, Washington, D.C. 20550.

This program is administered by the office of the Assistant Director for Research.

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Global Atmospheric Research Program

THE NATIONAL SCIENCE FOUNDATION awards grants to support research projects which involve the general circulation of the atmosphere and the physical basis of climate. Such research may improve the capacity of long-range weather prediction, and explore the feasibility of large-scale weather and climate modification.

The Global Atmospheric Research Program (GARP) is a long-term commitment by many nations. Within the United States, by formal agreement among Federal agencies, the Foundation is the primary agency for the support of non-Federal research in the program, particularly at universities. The Department of Commerce is the primary agency for Federal activities.

Grants are normally made for periods up to 24 months. Projects of high scientific merit may be approved scientifically for periods up to 60 months, and will be funded on an annual basis for the term of the approval, contingent upon the availability of funds and the scientific progress of the research.

Eligibility

Institutions eligible to submit proposals under GARP are colleges and universities; nonacademic, nonprofit organizations; and individual scientists. Occasionally NSF sponsors supporting efforts by other Government agencies, particularly for field programs.

Before submitting a research proposal, the NSF brochure GRANTS FOR SCIENTIFIC RESEARCH, available from the Foundation, should be consulted.

Deadlines

Proposals may be submitted at any time; approximately 3 months are required for consideration of a proposal.

Additional Information

Communications may be addressed to: Division of Environmental Sciences, National Science Foundation, Washington, D.C. 20550.

This program is administered by the office of the Assistant Director for Research.

International Decade of Ocean Exploration

IN SUPPORT OF THE International Decade of Ocean Exploration (IDOE), the National Science Foundation awards grants and contracts for cooperative programs of ocean research and exploration with emphasis on environmental quality, environmental forecasting, seabed assessment, and living resources. The program supports a relatively small number of research projects which concentrate on broad scientific problems especially susceptible to concerted effort by the research community. Emphasis is placed upon scientific excellence and applicability of results. The Decade is unique in that it brings major efforts to bear on globally planned and coordinated studies of the ocean as a system.

The long-range goals of the Decade are:

(1) to preserve the ocean environment by accelerating scientific observation of the natural state of the ocean and its interactions with the continental margins;

(2) to develop and improve an ocean forecasting and monitoring system, to facilitate prediction of oceanographic and atmospheric conditions, and to reduce hazards to life and property and permit more effective use of marine resources;

(3) to expand seabed assessment activities to permit better management of ocean mineral exploration and exploitation.

(4) to improve worldwide oceanographic data exchange; and

(5) to increase opportunities for international sharing of responsibilities and costs for ocean exploration and assure better use of limited exploration resources.

The U.S. national program and other nations' IDOE programs are coordinated closely with the Long-Term and Expanded Program of Oceanic Exploration and Research of the Intergovernmental Oceanographic Commission of UNESCO. IDOE is identified as "the acceleration phase" of this program.

Eligibility

Industry and other organizations are eligible for support on the same basis as educational institutions in the Foundation's International Decade of Ocean Exploration program. Universities will receive support in the areas of research suited to their expertise. Unsolicited research proposals are subject to cost-sharing. Proposals are solicited as necessary in certain areas. Awards resulting from solicited proposals may provide full costs, with cost-sharing or fees negotiated as appropriate.

Guidelines on eligibility, programs, and proposal preparation are contained in the NSF publication INTERNATIONAL DECADE OF OCEAN EXPLORATION—A GUIDE TO THE PREPARATION OF PROPOSALS, which may be obtained from the Foundation.

Deadlines

Proposals may be submitted at any time, or in response to Request for Proposals, as appropriate.

Additional Information

Communications should be addressed to: Office for the International Decade of Ocean Exploration, National Science Foundation, Washington, D.C. 20550.

Arctic Research Program

IN FISCAL YEAR 1971, as a result of the designation of the National Science Foundation as lead agency for the extension of Federal research in the Arctic, an Arctic Research Program was initiated to provide support for academic research and to coordinate the Foundation program with other agency programs.

This program, administered by the Office of Polar Programs, has four objectives: (1) to increase man's knowledge of the arctic environment and its dynamic parameters and to make intelligent use of the resources of the region; (2) to provide increased coordination of the arctic research programs of the Federal agencies; (3) to increase cooperation in research with other nations having arctic interests; and (4) to develop mechanisms for the exchange of scientific data and research plans, nationally and internationally.

Within the Arctic Research Program are seven areas of concentration: marine research, including the polar pack ice; terrestrial biology, including analysis of the ecosystem; Man in the Arctic; atmospheric science, including solar terrestrial physics; glaciology, including permafrost; geology and geophysics; and information services.

The Foundation has in the past supported activities in the Arctic region through grants and contracts awarded by existing program elements of various offices and divisions. These programs will continue to support such activities.

Coordination of Federal agency research is accomplished through the Interagency Arctic Research Coordinating Committee (IARCC), which is composed of representatives of the 12 agencies sponsoring research in the Arctic or Subarctic and chaired by the National Science Foundation. The Foundation publishes a quarterly *Arctic Bulletin* on behalf of the IARCC. It is available on request from the address below.

Eligibility

Universities, colleges, and academically related nonprofit research organizations may submit proposals for grants or contracts for research project support. Industry and other organizations are eligible for support for solicited proposals which normally are funded for 1 year, but may be funded for up to 5 years under certain circumstances.

Because of far-reaching scientific, logistic, and international implications of Arctic research projects, it is essential that scientists specify all field needs and requirements when submitting proposals. Proposers should also consult the Foundation's brochure GRANTS FOR SCIENTIFIC RESEARCH. Requests for support of field research should be submitted 1 year before the investigators wish to go into the field.

Additional Information

Communications should be addressed to: Office of Polar Programs, National Science Foundation, Washington, D.C. 20550.

U.S. Antarctic Research Program

THE NATIONAL SCIENCE FOUNDATION awards grants or contracts to support field research in Antarctica and to support study of resulting specimens or data in the United States.

Administered entirely by the Foundation, the U.S. Antarctic Research Program supports projects in all relevant sciences—human behavior, biology, cartography, geology, glaciology, meteorology, oceanography, solid-earth geophysics, and upper atmosphere physics.

After continuous work since the 1957-58 International Geophysical Year, an initial survey of the continent and its surrounding seas is nearing completion. Now, in addition to work by individual scientists or small groups, large technological projects—usually interdisciplinary and international— are under way to investigate specific processes, many of which have global relevance: drilling into bedrock to retrieve the continent's first deep rock cores, mounting a four-nation project that will lead to understanding of the mass budget of the ice cap, evaluating the living resources of the southern ocean, measuring worldwide pollution levels, and working toward the ability to predict long-range changes in global climate.

Field research can be carried out year-round at U.S. stations in the Antarctic Peninsula, in Ellsworth Land, on Ross Island, and at the geographic South Pole. From early October to late February, frequent air service is provided for scientists between the United States and all stations except the one on the Antarctic Peninsula, which is serviced by the Foundation's 125-foot research ship *Hero* from December to April. In the austral summer, temporary camps can be established within a wide radius of the permanent stations to meet specific research requirements. Austral summer research is carried out aboard icebreakers in the pack ice. Arrangements sometimes are made with other countries for support of research at their antarctic stations.

Stateside support is given as required for science information activities, including the ongoing *Antarctic Bibliography* and sorting centers for geological and biological specimens and for deep-sea sedimentary cores. The Foundation publishes the bimonthly *Antarctic Journal of the United States* (U.S. Government Printing Office, $6.50 per year, $8.25 foreign) to report field activities, preliminary findings, and trends in the program.

Eligibility

Universities, colleges, and academically related nonprofit research organizations may submit proposals for grants or contracts for research project support. Industry and other organizations are eligible for support for solicited proposals. Projects normally are funded for 1 year but under certain circumstances may be funded for up to 5 years. Multiyear projects of high scientific merit may be given assurance of support for the full term of the project, contingent upon availability of funds and scientific progress.

Because of far-reaching scientific, logistic, and international implications of all antarctic research projects, it is essential that scientists specify all field needs and requirements when submitting proposals. Proposers also should consult the Foundation's brochure GRANTS FOR SCIENTIFIC RESEARCH. Requests for support of field research should be submitted 1 year before the investigators wish to go into the field.

Additional Information

Communications should be addressed to: Office of Polar Programs, National Science Foundation, Washington, D.C. 20550.

Ocean Sediment Coring Program

THE NATIONAL SCIENCE FOUNDATION sponsors the acquisition of geologic samples from the floor of the deep ocean basins by means of rotary drilling and coring in the sediments and the underlying crystalline rocks. Portions of the core samples are made available to qualified scientists for individual research projects.

The major activity under the program is known as the Deep Sea Drilling Project, managed by the Scripps Institution of Oceanography of the University of California, San Diego. The drilling and coring operations are performed aboard the ship *Glomar Challenger*. About 60 deep ocean sites are occupied per year, yielding about 20,000 linear feet of 2 1/2-inch-diameter cores. Drill sites have been located in water depths exceeding 20,000 feet, and sub-bottom penetrations of more than 4,200 feet have been achieved. Since August 1968, about 470 holes have been drilled and cored at about 310 sites in the Atlantic, Pacific, and Indian Oceans; the Mediterranean, Caribbean, Bering, and Red Seas; and the Gulf of Mexico. Operations are continuing, with the ship presently drilling in the Pacific Ocean.

About 10 to 12 scientists participate aboard the drilling ship for each 2-month cruise, describing the cores lithologically and paleontologically as they come on board. These descriptions and resulting interpretations, along with those from shore-based laboratories, are published in a series of volumes—*Initial Reports of the Deep Sea Drilling Project*, one volume for each cruise. The volumes are placed with all major libraries, and are available for purchase by individuals from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Samples of core material for detailed analysis are available to qualified scientists throughout the world a year after the completion of the cruise that collected the cores.

Eligibility

Proposals for grants for studies of the core material may be submitted by academic institutions, nonprofit organizations, and individual scientists.

Deadlines

Proposals may be submitted at any time. Approximately 6 months are required to consider a proposal.

Additional Information

Communications should be addressed to: Office of National Centers and Facilities Operations, National Science Foundation, Washington, D.C. 20550.

Suggestions for scientific planning, including sites to be included on the drilling itinerary, may be addressed to: Manager, Deep Sea Drilling Project, Scripps Institution of Oceanography, University of California, San Diego, Calif. 92037.

Requests for samples of the core material may be directed to: Curator, Deep Sea Drilling Project, address as above.

Scientists interested in participating aboard the drilling ship may write to: Chief Scientist, Deep Sea Drilling Project, address as above.

Proposals for studies of core materials should be submitted to: Earth Sciences Section, Division of Environmental Sciences, National Science Foundation, Washington, D.C. 20550.

Oceanographic Facilities and Support

THE NATIONAL SCIENCE FOUNDATION awards grants or contracts for support of construction, modification, conversion, purchase, and operation of oceanographic facilities which lend themselves to shared usage. Community arrangements for shared use of these facilities have been developed under the University National Oceanographic Laboratory System (UNOLS).

Facilities supported under this program are those required for research both in the open oceans and in the near-shore seas, in estuaries, and on the Great Lakes. Examples of such facilities are ships, boats, submersibles, aircraft, piers, shipboard and related shore computing capability, and environmental simulation units.

The Foundation encourages local contributions from non-Federal funds whenever possible; however, there is no fixed requirement as to the amount of funds that institutions must contribute.

Before submitting a proposal for support under this program, institutions should seek advice from the Office for Oceanographic Facilities and Support (OFS). Specific formats and instructions are available for certain program activities, such as ship operations support, shipboard technician support, and support of capital equipment.

Eligibility

The primary objective of OFS is to provide support for large and expensive oceanographic facilities in accordance with the demonstrated needs of NSF-funded research and training programs in the total academic oceanographic community. Access to NSF-funded facilities is assured to qualified users through UNOLS.

OFS support for major oceanographic facilities utilized by the academic community is concentrated at a limited number of institutions which are suitably located and have the logistic capability to carry out major facility operations. These facility-operator institutions have substantial ongoing oceanographic research programs of their own and also provide facilities support for research programs of non-operator institutions. Non-operator academic institutions with substantial oceanographic research programs may apply for direct facilities support if they can demonstrate the capability to conduct such operations to fulfill research requirements not now being met.

Deadlines

Ship operations, shipboard technician, and shipboard equipment proposals are due July 1 each year. Proposals requesting support for other activities may be submitted at any time during the year.

Additional Information

Communications should be addressed to: Office for Oceanographic Facilities and Support, National Science Foundation, Washington, D.C. 20550.

For information concerning UNOLS operations, communications should be addressed to: UNOLS Executive Secretary, Woods Hole Oceanographic Institution, Woods Hole, Mass. 02543.

III. RESEARCH APPLICATIONS

DURING RECENT YEARS THE National Science Foundation has developed improved capabilities to stimulate research efforts more immediately and directly related to problems of society and the environment.

The problems, challenges, and opportunities to which the scientific community must respond require careful and objective analysis, expansion of the pool of directly relevant knowledge, and considered efforts to make this knowledge available to interested users. Specific needs of the Nation provide the basis for program objectives and organization and management of the research supported under these programs. The principal program efforts included under Research Applications are presented under the collective heading Research Applied to National Needs (RANN). The major coordinated research programs administered under RANN are Energy Research and Technology, Advanced Technology Applications, Environmental Systems and Resources, Social Systems and Human Resources, and Exploratory Research and Problem Assessment. An additional element is comprised of the Intergovernmental Science and Research Utilization Programs, also included in the program descriptions on the following pages. Before submitting a proposal for research support, descriptive brochures on the RANN program and the Intergovernmental Science and Research Utilization Programs should be consulted.

The following criteria were utilized in developing the ongoing major coordinated research efforts of RANN.

- **Importance**—the significance and urgency of the problem area or the potential consequences for the Nation are great;
- **Payoff**—the benefits to be realized are significantly higher than the anticipated research and implementation costs;
- **Leverage**—science and technology can have a unique and substantial impact on the problem;
- **Readiness**—the effort is timely and scientifically ready and the skilled manpower is available;
- **Capability**—Federal, academic, and industrial capabilities exist to mount a successful research program;

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- **Need for Federal Action**—the research is not being conducted by private industry because the identifiable incentive is not sufficient or the market is fragmented;

- **Unique Position of NSF**—the NSF can most effectively serve the research needs of the Government because the problem;

  (a) falls between or outside areas of responsibility of other agencies;

  (b) spans the areas of responsibility of other agencies; or

  (c) relates to meeting longer range and special requirements of other agencies and the Nation.

Eligibility

Proposals may be submitted by colleges, universities, and profit and nonprofit organizations. These proposals may provide for collaborative arrangements with other universities, nonprofit and/or profit-making organizations.

Industry and other organizations are eligible to participate on the same basis as academic institutions in research related to national needs. Universities will continue to receive primary support in the areas of research suited to their special expertise. Unsolicited proposals are expected to offer a unique technical contribution and show strong relevance to program objectives to merit full evaluation. Such proposals are subject to cost-sharing. Proposals are solicited as necessary. Awards resulting from solicited proposals may provide full costs, with cost-sharing or fee negotiated as appropriate. Joint proposals from universities, nonprofit institutions, and industry are encouraged to bring broader capabilities as well as interdisciplinary skills to the support of the NSF Research Applications program.

Deadlines

Unsolicited proposals may be submitted at any time and should first be submitted in preliminary form for negotiation and discussion. Approximately 6 months are required for consideration of proposals. Program announcements, program solicitations, and requests for proposals may be issued from time to time in targeted areas. Such announcements will specify a deadline for submission.

Additional Information

The publication RESEARCH APPLIED TO NATIONAL NEEDS describes the guidelines for preparation of proposals to the RANN program. Communications relating to a specific program area may be addressed to the appropriate division or office: Division of Energy Research and Technology, Division of Advanced Technology Applications, Division of Environmental Systems and Resources, Division of Social Systems and Human Resources, Office of Exploratory Research and Problem Assessment, or Office of Intergovernmental Science and Research Utilization. General inquiries and requests for publications may be addressed to the Office of Programs and Resources, National Science Foundation, Washington, D.C. 20550.

Energy Research and Technology

THE ENERGY RESEARCH AND Technology Program supports research in areas which lead to the implmentation and utilization of new energy concepts and options. The research is an interdisciplinary undertaking in which matters concerned with technology, environment, social aspects, legal, economics, and technology assessment are investigated.

The three general objectives in advanced energy research and technology are to sponsor research on:

- Analysis of future, intermediate, and long-range needs and various strategies for meeting these needs.
- Environmental, economic, and social impacts of energy production, and use and means for assessing and ameliorating detrimental impacts.
- Neglected or otherwise underexploited technologies which may have significant impact on the energy problem.

Specific areas of emphasis include:

- Energy Systems—Research deals with the analysis and synthesis of alternative means of meeting U.S. energy requirements while satisfying environmental quality constraints; the analysis of energy research and development opportunities; and mathematical modeling of major sectors of the energy industry.
- Energy Resources—Research seeks to expedite the development of novel and innovative technology, and will allow the energy resources of the United States to be used in an effective and economical way.

Current emphasis is on coal and geothermal energy.

- Energy Conversion—Research applied to the development of improved technologies for conversion of heat to electricity and improved electrical energy storage.
- Solar Energy—Research in solar energy explores and develops the technologies needed for terrestrial applications of solar energy. The areas of research are solar heating and cooling of buildings, production of electrical power from solar radiation, generation of clean fuels by bioconversion of organic materials, and generation of power utilizing wind and ocean thermal gradients.
- Geothermal Energy—Research in geothermal energy will help to assess and prove the potential of geothermal energy as an energy resource.
- Energy and Fuel Transportation—Research seeks to develop improved methods to solve the complex problems posed by the transportation of energy from production to consumption sites including novel power transmission technologies, and the application of computer methodology to operating, planning, modeling, and optimizing these systems.

Advanced Technology Applications

THE PRINCIPAL GOALS OF the Advanced Technology Applications Program are to support technological research that contributes to the national economy and productivity, reduces the adverse economic and societal costs of destructive natural phenomena, reduces the adverse impacts of technology on society and the environment, and improves the quality of community life.

Disaster and Natural Hazard Research

The subprograms in this area are Earthquake Engineering and Fire Research. The natural hazards to be considered are primarily dynamic in nature and include earthquakes, tsunami and wind-induced waves, and unwanted fires.

Earthquake Engineering

The basic objectives of this program are to:

- Develop economically feasible design and construction methods for building earthquake-resistant structures.
- Develop methods of analysis which integrate acceptable structural risk with the natural hazard potential of proposed construction sites for the purpose of improved structural design and land-use decisions.
- Develop an improved understanding of social and economic consequences of individual and community policy decisions on earthquake-related issues.

Fire Research

The following objectives indicate the scope of the research:

- Increase the basic knowledge on the mechanisms of ignition and flame spread.
- Study specific classes of materials, particularly new materials for burning and the products of combustion.
- Obtain basic information on fabric flammability and associated hazards leading toward the setting of standards.
- Study flame spread mechanisms in structures.
- Develop models of flame spread.
- Develop knowledge of the mechanisms of flame suppressants.
- Seek improved means for fire detection, alarm, and control.

Technological Opportunities

Support may be provided for research activities that represent technological opportunities, such as advanced industrial processing, excavation technology, and instrumentation technology.

Advanced Industrial Processing

Enzyme Technology. The purpose of the Enzyme Technology Program is to stimulate the development of the engineering and technology required to facilitate increased industrial uses of enzymes. The program will support the development of uses of enzymes. The research involved will relate as closely as possible to those enzymes which have the potential for industrial importance. The objectives of the program include:

- Advancement of fermentation and cell culture technology for the production of enzymes.
- Advancement of technology for the isolation and purification of dissolved enzymes and of particle-bound enzymes.
- Advancement of technology of enzyme reaction systems using free and/or immobilized enzymes.

● Development and/or preliminary economic evaluation of new applications of enzymes.

Other Industrial Processes. Research in this area is focused on developing new technologies for mineral beneficiation and extraction in an economically and environmentally satisfactory way. Areas of interest include solution mining, systems studies, and metal processing techniques.

Industrial Automation. Research in this area will seek to increase substantially productivity in the manufacturing and service sectors of the economy by developing industrial automation systems, including automatic programming for numerically controlled machine tools.

Excavation Technology

The following areas are appropriate for research: (1) site investigation; (2) excavation material investigation; (3) ground support and tunnel lining technology; (4) systems technology and testing; (5) systems analysis and investigation; (6) excavation technology; (7) education and information dissemination; (8) testing and evaluation of cavity stability; (9) economic factors; (10) legal and institutional factors; and (11) material handling technology.

Instrumentation Technology

The purpose of this program is to support research projects leading to new uses and improvements of instrumentation on a broad range of pressing national problems. Emphasis in the program is on:

● Application of advanced instrumentation and techniques, including cryogenic technologies, to the development of potentially effective treatment for localized human cancers.

● Application of advanced instrumentation to the diagnosis and treatment of disease. This includes the development of new clinical diagnostic procedures based on the latest innovations in technology, the imaging of human organs with various types of radiation, and the non-invasive measurement of body composition and function, such as blood pressure and flow, utilizing hypersensitive magnetometers.

● Increasing the national productivity by developing new instrumentation and applications for industry.

Environmental Systems and Resources

THE PROGRAMS IN THE Environmental Systems and Resources Division develop scientific data and strategic frameworks to deal with environmental and natural resource problems, including the complex-trade-offs between economic and social development and environmental quality.

Research supported under these programs deals specifically with establishing baselines of environmental quality, the environmental consequences of modern technology, resource exploitation, procedures for resource recycling and long-range environmental management strategies.

Regional Environmental Systems

The purpose of this program is to study regional environments and resources in order to establish the scientific basis for their management and use. A major aim of the Regional Environmental Systems Program is the enhancement of man's capacity to select from the universe of development and management strategies those which most effectively achieve environmental quality objectives within the context of other societal goals.

Objectives of the program are:

- Define environmental problems, including those unique to a particular region and those common to many regions.
- Identify resources impacted and ecosystem relations to predict consequences of alternative schemes to correct environmental problems.
- Evaluate economic and legal mechanisms as management options available to decision-makers, the specific environmental effects of these options, and the potentially detrimental effects of other forms of public policy.
- Synthesize management schemes utilizing the necessary environmental, economic, and social information.
- Evaluate management schemes in relation to other policies designed to meet other societal objectives.

Major research efforts include studies of environmental aspects of:

- Coastal Zone Management
- Urban/Rural Environmental Management
- Land Use Allocation

Weather Modification

The overall purpose of the Weather Modification Program is to study those atmospheric mechanisms which can be or are being influenced by man to modify natural weather patterns and evaluate the impact of their modification upon society.

The specific objectives may be defined as follows:

- Develop a level of understanding of the mechanisms of hail formation in severe convective storms which will lead to a more reliable method of hail suppression.
- Develop a more adequate knowledge of the ice nucleation mechanism in the atmosphere which will result in a capability to measure and predict the consequences of a seeding operation.
- Develop sufficient understanding of the mechanisms by which human habitation may produce anomalies in the weather patterns that adverse effects may be forecast in advance and corrective action taken to minimize the impact.
- Develop new and more accurate concepts of how, when, and under what circumstances weather can be modified by artificial means.

- Increase our understanding of the social, economic, legal, and ecological impact of operational weather modification practices upon society.

Environmental Aspects of Trace Contaminants

This program is designed to develop an understanding of the impact on man and the environment of many known and potential environmental trace contaminants, such as manufacturing byproducts, agricultural and household wastes, oil and hazardous materials spillage and dissipation, and elements of the bio-geochemical environment for the purpose of understanding and control. Specific objectives are:

- Determine the levels of toxic substances in the environment, how and where they accumulate, and how they are destroyed.
- Assess the effects of these levels on animal (including man) and plant communities.
- Relate these findings to methods of control by current practices or new methods.

In order to attain these objectives:

- Toxic or hazardous substances must be separated from complex mixtures, identified, and measured.
- The movement and rates of flow of contaminants through the environment must be traced from their sources to their ultimate sinks.
- Target organisms along, and at the end of, the routes of flow and their sensitivity to toxic agents must be determined.
- The complex relationships between biotic communities and the affects of the biologically available toxicants must be understood.
- Research results must suggest improved monitoring systems, and ultimately lead to technological, legal, and economic abatement or control measures.

The major research elements are:

- Trace Contaminants in Biota and Food Chains
- Concentrations, Routes, and Rates of Flow
- Chemical Changes in Trace Contaminants
- Techniques for Measuring Specific Environmental Pollutants.

Social Systems and Human Resources

THE RANN PROGRAM IN Social Systems and Human Resources has three principal objectives:

- To identify, analyze, and contribute knowledge to the solution of important municipal problems.
- To identify, analyze, and evaluate more effective, efficient, and equitable ways of delivering human services.
- To develop the data base and analytical techniques required for improved applied research on municipal systems and human services delivery.

Municipal Systems and Services

The objectives of this program are:

- Provide knowledge which will help improve the use of existing municipal resources and improve the effectiveness of municipal governments in delivering public goods and services.
- Evaluate attractive applications of new urban technologies, with emphasis on the ways in which social and technical systems can best be joined.
- Evaluate the benefits and costs of alternative organizational and institutional mechanisms for coping with the problems of municipal governments.

Human Resources and Services

The objectives of this program element are to:

- Find more effective, efficient, and equitable means to deliver human services, that is, services provided directly to individuals or groups of individuals.
- Match the demand for services with appropriate supply, in terms of both quality and quantity.
- Produce information and analyses required for the development and evaluation of social programs and policies.

The following areas have been selected for special emphasis:

- Analysis of Service Delivery Organizations
- Distributional Effects of Public Expenditures and Taxes
- Law, Science, and Technology

Social Data and Evaluation

The objectives of this program element are to develop the data base and evaluation techniques needed to carry out more effective applied research on municipal and human services delivery systems. In addition, this program element supports analysis of alternatives for the implementation and utilization of the results of applied social research.

- Community and population structure work focused on creating baseline descriptions of the socioeconomic structure of American communities and of the American population.
- Improving social data utilization—This research examines the factors that influence the demand for and the supply of applied social research and policy research and the approaches and methods used.
- Evaluation techniques for social programs—Research is conducted on the use of evaluations and social experiments in setting priorities for future social programs and on comparing and analyzing the experience of Government agencies in conducting social experiments.

Exploratory Research and Problem Assessment

THIS PROGRAM SUPPORTS EXPLORATORY research and assessment projects to determine which national problems may be amenable to amelioration through the application of science and engineering capabilities. Assessments will help to define the role of science in dealing with societal problems and will also examine the impact of science and technology on society. Principal goals are: to define adequately the broad context of particular societal problems; and to identify those research opportunities and strategies which are critical to dealing with the problems. In this way, new areas of potential research investment for RANN or other agencies can be identified and the prospects for a more extensive program assessed. Major components of the program are:

Technology Assessment

Technology assessment is the systematic study of the effects on society that may occur when a technology is introduced, extended, or modified, with special emphasis on the impacts that are unintended, indirect, or delayed.

Technology assessment may be viewed as one aid to the generation of public policy options with regard to the management of technology and as an input in the decision-making process. Assessment of physical, biological, and social technologies are all suitable for consideration under this program.

Problem Assessment and Exploratory Research

Problem assessment and technology assessment studies may extend across the full range of national and social issues. Exploratory research is limited to areas which have been identified as gaps in Federal and private research activity, which have high potential payoff for the Nation, and which otherwise satisfy the general RANN criteria.

The range and type of problem areas planned for this research program include:

Minority Group Problems. Research will explore alternative mechanisms and methodologies for obtaining improved information on the nature and extent of problems affecting the disadvantaged minorities; on identifying policy-significant characteristics of minority communities; on exploring the interactions between society and programs which have special impacts upon minority populations; and on utilizing the talents of minority scientists and leadership in determining research priorities and in designing and conducting research projects.

The Consumer and Marketplace. Undertake problem assessments and exploratory research on the interacting roles of the consumer and the marketplace. Emphasis will include issues of consumer safety and protection, consumer information, and consumer behavior. Special consideration will be given to areas of interest to Federal regulatory agencies.

Social Implications of an Aging Population. Conduct problem assessments on the societal consequences of a changing age distribution. The emphasis will be on the longer term social aspects of gerontology.

Technology-Related Transnational Problems. Problem-oriented multidisciplinary research will be applied systematically to selected technology-related transnational policy issues which need urgent attention by the United States and the international community.

Other Societal Problems. Providing needed assessment and exploratory research in response to creative, innovative ideas and approaches, where the societal problem satisfies the general RANN criteria but falls outside of the above-defined areas or the programs of RANN. Included under this category are selected "trans-national" problems in which science and technology play an important role, and which currently represent important policy questions for the United States or correspond to particular national needs.

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Intergovernmental Science Programs

THE NATIONAL SCIENCE FOUNDATION awards grants to enable State and local levels of government to develop new and improved programs and institutions for the systematic application of science and technology to governmental problems, and for the utilization of research resulting from NSF applied research programs.

The objectives of the Intergovernmental Science Programs are to:

- Advance the capability of State and local governments to understand the technological and scientific facets of issues and problems;
- Assess opportunities for more effective application of science and technology;
- Demonstrate innovative science and technology planning and decision-making processes relevant to State, local and regional problems;
- Stimulate selected State and local governmental experimentation with science and technology systems appropriate to their own needs and resources;
- Develop policies, programs, procedures, and detailed plans to promote the full utilization of RANN research in relevant national need areas;
- Stimulate the development of public and private user capability to implement RANN research results;
- Support the RANN program in the conduct of research utilization activities.

The proposed activity must involve a problem of general interest to State and local governments. Preference will be given to innovative approaches to the development of models for governmental use of science and technology. Activities supported may include development of mechanisms, manpower, and education programs (involving State and local government officials), technology assessment and forecasting studies, research utilization and information transfer, and exploratory studies to help develop science and technology-related innovative policies and programs for State and local governments. Institutional support may be provided to assist in establishment of centers for governmentally related science and technology applications. Conferences and seminar projects at the State, regional, and national levels, and projects to collect and analyze data on State and local scientific and technical resources may also be supported.

Eligibility

Proposals may be submitted by units of State and local governments and their State, regional, or national organizations, legislatures, professional schools, State academies of science, colleges, universities, and nonprofit institutions. Proposals combining academic institutions and units of government will be of particular interest. There is no requirement for matching funds, but normally applicants are required to share in the cost of any proposed activity. Contractual arrangements are made on occasion with profit-making organizations for the performance of work in which they are uniquely qualified.

Proposals may be submitted to other Federal agencies for partial support and to NSF for those activities that fall outside the program scope of other Federal agencies.

Deadlines

Proposals may be submitted at any time; processing of a proposal requires approximately 6 months. Informal inquiry to the Foundation may be made to determine whether or not a potential project would qualify for support.

IV. NATIONAL RESEARCH CENTERS

The National Science Foundation provides support for the development and operation of National Research Centers established to meet national needs for research in specific areas of science requiring facilities, equipment, staffing, and operational support which are beyond the capabilities of private or State institutions and which could not appropriately be provided to a single institution to the exclusion of others. Unlike many federally sponsored research laboratories, the NSF-supported National Research Centers do not perform specific research tasks assigned by or for the direct benefit of the Government. They are maintained for the purpose of making available, to all qualified scientists, the facilities, equipment, skilled personnel support, and other resources required for the performance of independent research of the scientists' own choosing, in the applicable areas of science.

The Foundation supports four astronomy centers (National Astronomy and Ionosphere Center at Arecibo, Puerto Rico; Cerro Tololo Inter-American Observatory near Santiago, Chile; Kitt Peak National Observatory at Tucson, Ariz.; and National Radio Astronomy Observatory at Green Bank, W. Va.) and one atmospheric research center (National Center for Atmospheric Research, Boulder, Colo.).

The centers are managed by the Office of National Centers and Facilities Operations in the Directorate for National and International Programs. More detailed information on each of these National Research Centers is given on the following pages.

National Astronomy and Ionosphere Center

THE NATIONAL SCIENCE FOUNDATION supports the National Astronomy and Ionosphere Center at Arecibo (Puerto Rico), for the conduct of radio astronomy, radar astronomy, and ionospheric research. The observatory is managed and operated by Cornell University under contract with the Foundation.

The world's largest reflector, a 1,000-foot-diameter spherical fixed telescope, is located at the Arecibo observatory. The immense size of this research instrument has enabled it to make unique and significant contributions to understanding of the earth's atmosphere, the solar system, and radio sources outside of the solar system.

The major objective of the observatory is to make available on a national basis radio and radar facilities that will enable it to contribute significantly to new discoveries in the fields of ionospheric studies, lunar and planetary radar, and radio astronomy. An upgrading is in progress to provide a new reflector surface and a high power S-band radar transmitter. The new surface will enable the telescope to be operated to wavelengths as short as 6 cm in lieu of the present 50-cm wavelength. The NASA-sponsored transmitter will provide a high resolution planetary mapping capability at 12.6-cm wavelengths.

Arecibo has a small permanent staff of scientists, engineers, and technicians who are available to assist visiting scientists and observers.

Eligibility

All qualified U.S. scientists and, on occasion, foreign visitors may use the instruments, subject to priorities based on the scientific merit of the proposed research, the capability of the instruments to do the work proposed, and the time available.

Additional Information

Communications should be addressed to: Director, National Astronomy and Ionosphere Center, Cornell University, Ithaca, N.Y. 14850.

Kitt Peak National Observatory

THE NATIONAL SCIENCE FOUNDATION supports the Kitt Peak National Observatory (KPNO), which makes available optical telescopes, observing equipment, and research support services to qualified scientists.

The headquarters of KPNO is in Tucson, Ariz.; observing facilities are located atop Kitt Peak, about 50 miles southwest of Tucson. KPNO is supported under the terms of a contract between the Foundation and the Association of Universities for Research in Astronomy, Inc.

Major astronomical instruments at Kitt Peak include the largest solar telescope, of 1.5-meter aperture; the world's second largest stellar telescope, of 4-meter diameter; a 2.1-meter general-purpose reflector; a 1.3-meter cassegrain reflector; and two 92-centimeter and two 41-centimeter reflectors. The observatory also maintains a planetary astronomy program which includes theoretical and observational studies.

KPNO has a staff of resident scientists, engineers, and technicians who are available to assist visiting scientists and observers.

Eligibility

KPNO makes observing time on each instrument available for the use of visiting scientists. All qualified U.S. scientists and, on occasion, foreign visitors may use the instruments, subject to priorities based on the scientific merit of the proposed research, the capability of the instruments to do the work, and the available time.

Additional Information

Communications should be addressed to: Director, Kitt Peak National Observatory, 950 North Cherry Avenue, P.O. Box 26732, Tucson, Ariz. 85726.

Cerro Tololo Inter-American Observatory

THE NATIONAL SCIENCE FOUNDATION supports the Cerro Tololo Inter-American Observatory (CTIO), an astronomical research center whose optical telescopes and related facilities are available to qualified scientists from the United States, Chile, and elsewhere in North and South America. Using telescopes made available by the Federal Government and other organizations, CTIO provides astronomers with the opportunity to observe those parts of the Southern Hemisphere skies that are not visible or not adequately observable from the United States.

The observing facilities of CTIO are located on a 7,200-foot mountain in the foothills of the Andes Mountains about 300 miles north of Santiago, Chile. The administrative headquarters is in the coastal city of La Serena, about 60 miles away. CTIO is supported under the terms of a contract between the Foundation and the Association of Universities for Research in Astronomy, Inc., which also operates the Kitt Peak National Observatory (KPNO). Close ties are maintained with the University of Chile.

Major astronomical instruments at Cerro Tololo include a 1.5-meter, 92-centimeter, 61-centimeter, and two 41-centimeter cassegrain reflectors. Also available on Cerro Tololo are a 1.0-meter reflector and a 61-centimeter aperture Schmidt telescope on long-term loan from Yale University and the University of Michigan, respectively. A 4.0-meter reflecting telescope, identical to the 4-meter telescope at KPNO, is scheduled for operation in 1974.

Cerro Tololo has a small permanent staff of scientists, engineers, and technicians who are available to assist visiting scientists and observers.

Eligibility

Most of the observing time at Cerro Tololo is used by visiting astronomers. Qualified scientists may use the instruments subject to priorities based on the scientific merit of the proposed research, the capability of the instruments to do the work proposed, and the available time.

Additional Information

Communications should be addressed to: Director, Kitt Peak National Observatory, 950 North Cherry Avenue, P.O. Box 26732, Tucson, Ariz. 85726.

National Radio Astronomy Observatory

THE NATIONAL SCIENCE FOUNDATION supports the National Radio Astronomy Observatory (NRAO), through which Government-owned radio astronomy facilities are made available to qualified scientists. The NRAO staff assists visiting scientists with the large radio antennas, receivers, and other equipment needed to detect, measure, and identify radio waves from outer space.

Headquarters for NRAO is in Charlottesville, Va.; observing facilities are located primarily in Green Bank, W. Va. NRAO is supported under the terms of a contract between the Foundation and Associated Universities, Inc. (AUI), a nonprofit corporation.

Major research facilities at NRAO include a 140-foot highly precise, fully steerable radio telescope; an interferometer consisting of three fully steerable 85-foot telescopes with a portable 42-foot telescope for remote operation; and a 300-foot radio telescope steerable in declination (latitude) only. A 36-foot radio telescope operating at millimeter wavelengths is located at the Kitt Peak National Observatory near Tucson, Ariz. NRAO has a small staff of resident scientists, engineers, and technicians.

NRAO has also provided the design for the Very Large Array (VLA) Radio Telescope Facility to be constructed by AUI on the Plains of San Augustin near Socorro, N. Mex., over the next several years. This major new astronomical instrument will utilize an array of 27 radio telescopes, each 82 feet in diameter, to obtain celestial radio images comparable to the photographic images obtained with the largest optical telescopes.

Eligibility

NRAO makes observing time on each instrument available for the use of visiting scientists. All qualified U.S. scientists and, on occasion, foreign visitors may use the instruments, subject to priorities based on the scientific merit of the proposed research, the capability of the instruments to do the work proposed, and the time available.

Additional Information

Communications should be addressed to: Director, National Radio Astronomy Observatory, Charlottesville, Va. 22901.

National Center for Atmospheric Research

THE NATIONAL SCIENCE FOUNDATION supports the National Center for Atmospheric Research (NCAR) which serves as a focal point for an expanding national research effort in the atmospheric sciences. NCAR offers support services, fellowships, and research facilities to qualified scientists working in the field of atmospheric research.

Headquarters and major laboratories of NCAR are located in Boulder, Colo. Research activities and operations are worldwide. Support of NCAR is provided under the terms of a contract between the Foundation and the University Corporation for Atmospheric Research, a nonprofit corporation.

Research programs of NCAR include investigation of the earth's atmosphere, of the physics of the Sun, and of the regions between the Sun and Earth. NCAR facilities in support of NCAR and of visiting scientists include a National Scientific Balloon Facility at Palestine, Tex., a Computing Facility at Boulder, and an Aviation Facility at Broomfield, Colo.

In addition to conducting its own research programs, NCAR participates in a number of atmospheric research efforts conducted by Government agencies, university scientists, and research groups on a national or international scale. Major efforts include development of computer simulation of atmospheric global circulation patterns and convective cloud processes, measurement of chemical constituents of the atmosphere, theoretical studies and observations of solar-terrestrial phenomena, investigation of the atmospheric conditions responsible for the formation of hailstorms, and development of techniques to abate hail formation. More than 600 scientists, engineers, technicians, and support personnel comprise the NCAR staff.

Eligibility

Visiting scientists study and conduct research at NCAR under fellowships and research programs. NCAR facilities are available to qualified scientists, subject to scheduling considerations.

Additional Information

Communications should be addressed to: Director, National Center for Atmospheric Research, P.O. Box 1470, Boulder, Colo. 80302.

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V. INTERNATIONAL COOPERATIVE SCIENTIFIC ACTIVITIES

The Foundation encourages and supports U.S. scientific participation in international science programs and activities that promise maximum benefit to the U.S. science effort.

It is Foundation policy to foster the interchange of information among scientists in the United States and foreign countries, initiate and support scientific activities in connection with matters relating to international cooperation, support basic research abroad (in special cases) as a supplement to the national research effort, and provide support to U.S. institutions for research which is to be conducted abroad.

Programs described in this chapter are administered by the Office of International Programs (OIP) and complement other Foundation activities in support of scientific research and science education. OIP welcomes inquiries about any of the programs listed and encourages U.S. scientists and engineers to discuss with this office plans and new approaches to international cooperation in science.

OIP is a component of the Directorate for National and International Programs.

United States-Australia Cooperative Science Program

THE NATIONAL SCIENCE FOUNDATION coordinates the participation of U.S. scientists, organizations, and agencies in this program under the United States-Australia Agreement for Scientific and Technical Cooperation. The purpose of the agreement is to provide additional opportunities to exchange ideas, information, skills, and techniques; to collaborate on problems of mutual interest; to work together in unique environments; and to utilize special facilities. Participating scientists may be in civil agencies of the Government or in academic or other institutions.

Joint activities which further cooperation may include:

(1) Exchange of scientists and technical experts.
(2) Pursuit of joint research activities.
(3) Convocation of joint seminars and workshops.

Funds for the support of the activities of American scientists may come from any U.S. source including the National Science Foundation. The support of participating Australian scientists must come from Australian sources. Special funds are available from the Foundation for the support of visiting scientists and joint seminars.

Each activity in the program requires approval by the Foundation and by the Commonwealth Department of Science, the executive agencies responsible for carrying out the terms of the agreement in the United States and Australia. Nothing in the agreement is intended to prejudice other arrangements for scientific and technical cooperation between the two countries.

Additional Information

Communications may be addressed to: United States-Australia Cooperative Science Program, Office of International Programs, National Science Foundation, Washington, D.C. 20550.

United States-Republic of China Cooperative Science Program

THE NATIONAL SCIENCE FOUNDATION awards grants to support the participation of U.S. scientists in the United States-Republic of China Cooperative Science Program. Chinese funds support Chinese scientists participating in the program.

Three types of projects are supported in the program:

(1) Joint research projects.
(2) Visiting scientists.
(3) Scientific seminars.

A brochure describing the United States-Republic of China Cooperative Science Program is available from the Foundation, together with guidelines for submitting proposals.

Eligibility

Those eligible to submit proposals are colleges and universities, individual scientists, or groups of scientists. The program is aimed primarily at the academic scientist; however, others may be considered. An informal inquiry to the Foundation should be made before a formal proposal is submitted. All projects must be approved by the Foundation and the National Science Council in Taipei.

Deadlines

Proposals may be submitted at any time; approximately 6 months are needed for consideration.

Additional Information

Communications may be addressed to: United States-Republic of China Cooperative Science Program, Office of International Programs, National Science Foundation, Washington, D.C. 20550.

East Europe Cooperative Science Programs: Romania, Hungary, Czechoslovakia

THESE PROGRAMS ARE OFFERED to foster and support scientific and technological cooperation on a bilateral basis between the United States and each of the cooperating countries. The programs are conducted and coordinated between the National Science Foundation and comparable organizations in the cooperating countries.

Under these programs, research-oriented cooperative activities may be conducted and supported in any branch of science and technology, including basic and applied aspects of the natural sciences and mathematics, the engineering sciences, and the social sciences, and including interdisciplinary or problem-oriented areas. Support is offered for three types of activities:

(1) **Cooperative research**—projects designed jointly by, and to be conducted collaboratively between, a principal investigator of the United States and a principal investigator of the cooperating foreign country. Proposals are submitted by an American institution to the National Science Foundation and by the institution of a foreign investigator to the coordinating agency in his country.

(2) **Seminars**—meetings of small groups of scientists of the United States and of the foreign country, jointly designed and convened by American and foreign co-organizers. A seminar may be held in the United States or in the cooperating foreign country. Proposals are submitted by the American co-organizer or his institution to the National Science Foundation and by the foreign co-organizer through his institution to the coordinating agency in his country.

(3) **Scientific visits**—visits of short duration for the purpose of planning cooperative scientific activities or conferring about cooperative scientific activities; also, with Romania, visits of longer duration for purposes of research, study, or lecturing. The application of an American scientist to visit one or more of the cooperating countries is submitted by him to the National Science Foundation; the application of a foreign scientist to visit the United States is submitted by him or by his institution to the coordinating agency in his own country.

Eligibility

American institutions eligible to participate in these programs include universities and colleges, professional societies, academies of sciences, and other nonprofit scientific organizations of the private or public sectors. Support is available for American scientists who are U.S. citizens or who have at least 5 years of professional employment beyond the doctorate in U.S. institutions and are currently affiliated with an eligible U.S. institution. American scientists employed by profit-making organizations are not eligible for support.

Additional Information

The brochure COOPERATIVE SCIENCE PROGRAMS: ROMANIA, HUNGARY, CZECHOSLOVAKIA, BULGARIA; COOPERATIVE RESEARCH, JOINT SEMINARS, SCIENTIFIC VISITS is available from the Foundation.

Communications may be addressed to: East Europe Cooperative Science Programs, Office of International Programs, National Science Foundation, Washington, D.C. 20550.

United States-France Exchange of Scientists Program

THE NATIONAL SCIENCE FOUNDATION and the Centre National de la Recherche Scientifique jointly sponsor an exchange of scientists for study or research in the mathematical, physical, chemical engineering, biological, and social sciences, including economics. Awards are not made in the medical sciences or in education or business fields.

Eligibility

Eligible individuals are citizens or nationals of the United States and France who will have earned a doctoral degree or its equivalent normally not more than 5 years prior to the commencement of the exchange visit. Eligible institutions are, for American candidates, any appropriate nonprofit French institution. Appropriate nonprofit institutions are institutions of higher education; government research institutes, laboratories, or centers; and privately sponsored nonprofit institutes. The period of the exchange visit is normally between 5 and 15 months. French candidates may obtain information and application materials from the Centre National de la Recherche Scientifique. American candidates may obtain information and application materials from the address below.

Additional Information

Communications may be addressed to: United States-France Exchange of Scientists Program, Office of International Programs, National Science Foundation, Washington, D.C. 20550.

United States-India Exchange of Scientists Program

THE NATIONAL SCIENCE FOUNDATION administers the participation of U.S. scientists and engineers in a program of short-term exchanges with India for the purpose of exchanging scientific information and planning future scientific cooperation. In India the program is administered by the Council of Scientific and Industrial Research. These organizations are jointly responsible for approving each exchange visit. The National Science Foundation pays only travel costs of U.S. scientists to and from India. Within India, expenses are covered by the local hosts. A brochure describing this program is available from the Foundation.

Eligibility

Individual senior scientists and engineers are eligible to submit proposals. The evaluation of requests is based on the applicant's professional qualifications and the merit of the proposed activity in India.

Deadlines

Proposals may be submitted at any time.

Additional Information

Communications should be addressed to: United States-India Exchange of Scientists, Office of International Programs, National Science Foundation, Washington, D.C. 20550.

United States-Israel Binational Science Foundation

THE UNITED STATES-ISRAEL BINATIONAL Science Foundation (BSF) came into existence under an agreement between the two Governments, signed on September 27, 1972. It establishes a program of cooperative scientific research and related activities to be conducted principally in Israel, to be financed with Israeli currency, and involving scientists and institutions of the United States and Israel. Activities must be of mutual interest to the United States and Israel and concerned with science and technology for peaceful purposes. Activities dealing with scientific and technological information are also considered.

The BSF is operated with the interest from a fund contributed to equally by both countries. The U.S. contribution represents the unobligated residue of U.S.-owned Israeli currency, chiefly resulting from payments by the Government of Israel for surplus agricultural commodities sold under Public Law 83-480.

The interests and activities of the scientific agencies of the U.S. Government in BSF are coordinated through the Department of State. U.S. institutions may submit proposals in either of the following ways:

(1) Directed to a scientific agency of the U.S. Government having a mission related to the subject of the proposal. The agency forwards it to BSF with comments concerning the relevance of the proposal to the mission of the agency; judgments as to its scientific merit are the responsibility of BSF. NSF encourages the submission of proposals of high quality which complement or otherwise relate to research supported under NSF programs.

Such proposals may be addressed to:

Office of International Programs
(U.S.-Israel Binational Science Foundation)
National Science Foundation
Washington, D.C. 20550

Phone: (202) 632-5796

(2) Directed to the following address:

U.S.-Israel Binational Science Foundation
P.O. Box 7677
Jerusalem, Israel

Proposals submitted directly to BSF will later be referred by it to the U.S. Government for comment.

Deadlines

Although proposals may be submitted at any time, funding decisions are made in January and July of each year. To allow sufficient time for evaluation, proposals should be submitted no later than September 1 and March 1, 4 months prior to the times when decisions are made.

Additional Information

Inquiries about the preparation of proposals of interest to the National Science Foundation may be addressed to NSF at the address shown above.

The program described above is a program of the United States-Israel Binational Science Foundation and should not be confused with National Science Foundation programs. Consequently, institutions and investigators should be aware that standard NSF proposal and award guidelines and procedures are not applicable.

United States-Italy Cooperative Science Program

THE NATIONAL SCIENCE FOUNDATION coordinates the participation of U.S. scientists and institutions in the United States-Italy Cooperative Science Program.

The objectives of the program are to promote cooperation between scientists of the two countries for peaceful purposes and to provide additional opportunities for them to exchange ideas, skills, and techniques; to attack problems of particular mutual interest; to work together in unique environments; and to utilize special facilities.

Types of projects included in this program are:

(1) Joint research projects.
(2) Exchange of scientists, in connection with approved projects.
(3) Seminars to exchange information and plan cooperative research.

Each activity in the program involves participation by scientists of both countries and requires approval by the Foundation and by the Consiglio Nazionale delle Ricerche, the executive agencies responsible for carrying out the terms of the agreement in the United States and Italy. Nothing in the agreement is intended to prejudice other arrangements for scientific cooperation between the two countries.

Funds for the support of the activities of American scientists may come from any U.S. source, which includes but is not confined to the regular research support programs of the Foundation. In addition, limited OIP program funds are available for the support of visiting scientists, the organization of binational seminars, and for developmental cooperative research grants. Proposals are submitted to the appropriate funding agency or institution in accordance with its normal procedures. At the same time, the U.S. investigator sends a copy of his proposal to the address below, together with a copy of the joint application form, signed by him and the Italian principal investigator. A brochure describing the United States-Italy Cooperative Science Program is available from the Foundation, together with instructions and guidelines for submitting proposals.

Additional Information

Communications should be addressed to: United States-Italy Cooperative Science Program, Office of International Programs, National Science Foundation, Washington, D.C. 20550.

United States-Japan Cooperative Science Program

THE NATIONAL SCIENCE FOUNDATION awards grants to support the participation of U.S. scientists in the United States-Japan Cooperative Science Program. Japanese funds support Japanese scientists participating in the program.

Three types of projects are included in the program:

(1) Cooperative research in all areas of the natural sciences.
(2) Scientific seminars.
(3) Visiting scientists.

A brochure describing the United States-Japan Cooperative Science Program is available from the Foundation, together with guidelines for submitting proposals.

Eligibility

Those eligible to submit proposals are colleges and universities, nonprofit research institutions, individual scientists, or groups of scientists. The program is aimed primarily at the academic scientist; however, others may be considered. All projects must be approved by the Foundation and the Japan Society for the Promotion of Science.

Deadlines

Proposals for cooperative research may be submitted at any time; approximately 6 months are needed to consider a proposal. Proposals for seminars between October 1 and March 31 must be received by the preceding February 28; for seminars between April 1 and September 30, the receipt date is the preceding August 31. Proposals for visits to Japan beginning between any July 1 and June 30 period must be received by July 1 of the preceding year.

Additional Information

Communications should be addressed to: United States-Japan Cooperative Science Program, Office of International Programs, National Science Foundation, Washington, D.C. 20550.

United States-Latin America Cooperative Science Programs

THESE PROGRAMS ARE OFFERED to foster and support scientific cooperation on a bilateral basis between the United States and several Latin American countries. The National Science Foundation coordinates the participation of U.S. scientists in these programs under Agreements of Scientific and Technical Cooperation with the appropriate counterpart agencies in the countries involved. Formal agreements for which the National Science Foundation is responsible have been signed with Argentina, Brazil, and Mexico. Other countries in Latin America may also be considered.

Under these programs, research-oriented cooperative activities may be conducted and supported in any branch of science, unless specifically limited by mutual agreement between the coordinating agencies. Support is offered for three types of activities:

Cooperative research—projects designed jointly by and conducted collaboratively between principal investigators from the United States and from the cooperating foreign country. Proposals are submitted by a U.S. institution to the National Science Foundation and by the institution of a foreign investigator to the coordinating agency in his country.

Seminars—meetings of small groups of scientists of the United States and of the foreign country, jointly designed and convened by U.S. and foreign co-organizers. A seminar may be held in the United States or in the cooperating foreign country. Proposals are submitted by the U.S. co-organizer or his institution to the National Science Foundation and by the foreign co-organizer through his institution to the coordinating agency in his country.

Scientific visits— visits of short duration for the purpose of planning cooperative scientific activities or conferring about cooperative scientific activities; also, visits of longer duration for purposes of research. The application of a U.S. scientist to visit one or more of the cooperating countries is submitted by him to the National Science Foundation; the application of a foreign scientist to visit the United States is submitted by him or by his institution to the coordinating agency in his own country.

Eligibility

U.S. institutions eligible to participate in these programs include universities and colleges, professional societies, academies of sciences, and other nonprofit scientific organizations of the private or public sectors. Support is available only for U.S. scientists who are citizens of the United States or who have at least 5 years of professional employment beyond the doctorate in U.S. institutions and are currently affiliated with an eligible U.S. institution. U.S. scientists employed by profit-making organizations are not eligible for support.

Additional Information

Communications should be addressed to: United States-Latin America Cooperative Science Programs, Office of International Programs, National Science Foundation, Washington, D.C. 20550.

Scientists and Engineers in Economic Development Program

THE NATIONAL SCIENCE FOUNDATION, through a special program funded by the Agency for International Development (AID), will provide support for individual U.S. scientists and engineers to apply their experience to problems of development in 39 countries currently receiving assistance from AID.

The program's objectives are to enable U.S. scientists and engineers to share experiences with their counterparts in developing countries who formulate and conduct specific research and education programs contributing in a direct way to economic development in their countries; establish long-term collaborative relationships between U.S. and foreign institutions; and increase the capability of scientific and technical institutions in developing countries.

Types of projects included in this program are:

(1) **Research/Teaching Grants**—An individual may apply through his institution for support to enable him to conduct research or teach for 9 to 12 months in an academic institution of a developing country. Grants may provide stipend plus air travel allowance for scientists and dependents. Local costs in the foreign country must be met by the host institution.

(2) **International Travel Grants**—An individual may apply for an International Travel Grant to engage in research or teaching in institutions of developing countries for a period not to exceed 9 months. Grants will provide the cost of economy class air travel plus a small amount of incidental expenses. Per diem and local costs must be provided by the host institution.

Eligibility

Applicants are limited to scientists and engineers from U.S. academic institutions with at least 5 years of postdoctoral or equivalent experience in teaching or research and who will return to their institutions on completion of the project.

Proposals will be considered in the following fields: engineering, physical sciences, earth sciences, biological sciences, social sciences, and science education.

Evidence of the host institution's support for the proposed project must be shown.

Additional Information

Communications should be addressed to: Scientists and Engineers in Economic Development Program, Office of International Programs, National Science Foundation, Washington, D.C. 20550.

VI. SCIENCE EDUCATION

The major objectives of the NSF Science Education Program are to:

- Help assure the Nation of an appropriate variety, flexibility, quality, and number of scientific and technological manpower with greater participation of minorities and women.

- Improve science education to meet the needs of a broader range of students and to increase substantially the number of persons who make effective use of the processes and results of science in their work and personal lives whether or not they are engaged in scientific or technical occupations; and understand public issues involving science and technology.

- Improve the effectiveness and efficiency of science education through the application of improved programs involving modern educational technologies; new instructional strategies and methodologies; and knowledge gained from research on the processes of learning and education.

- Finds ways to increase the impact and effectiveness of the Foundation's Science Education Programs through research and problem assessment which can point to necessary future program directions.

Program activities are structured around five major themes:

- Improvement of Education for Careers in Science
- Development of Science Literacy
- Increasing the Efficiency of Educational Processes
- Experimental Projects and Problem Assessment, and
- Support of Graduate Students.

The following summary provides a perspective of the objectives of each of these themes and a brief description of the related program elements. The descriptions are not intended to be guides for the preparation of proposals; such guides should be requested separately and are referenced in each description. The great majority of proposals for projects to improve education in the sciences received by the Foundation are submitted by colleges and universities on behalf of their staff members. Proposals may also be submitted by nonprofit organizations such as professional, scientific, and educational societies; research institutes and

laboratories; and educational consortia. Proposals from individuals acting independently of institutional sponsorship, State or local school systems, and industrial (profit-making, commercial) organizations have not normally been direct recipients of Foundation support for projects to improve science education. Prospective proposers should consult the specific program guide for preparation of proposals regarding details of eligibility. In requesting guidelines, please identify by brochure number and title. Requests should be made by individual postcard addressed to:

National Science Foundation
Forms and Publications Unit
Washington, D.C. 20550.

Other inquiries related to the respective programs should be sent to the staff unit referenced in each program description.

Improvement of Education for Careers in Science

THE CENTRAL OBJECTIVE IS to help assure an appropriate number, variety, flexibility, and quality of professional scientific and technological manpower, with greater participation by ethnic minority groups and women, to meet the Nation's needs. Programs are addressed not only to the problem of maintaining the quality of training in the traditional science disciplines but also to the development of new instructional patterns and new instructional programs, single- or interdisciplinary, leading to a wider variety of scientific and technical career options for individuals ranging from secondary school graduates to graduate degree-holders.

The following programs are included:

- Secondary School Program
  - — Materials and Instruction Development
  - — Instructional Improvement Implementation
- Alternatives in Higher Education Program
  - — Instructional Materials and Modes Development
  - — Alternative Degree Programs
  - — Science and Engineering Technician Education
  - — College Faculty Workshops
  - — Faculty Research Participation
  - — Instructional Scientific Equipment Program
- Continuing Education for Scientists and Engineers
- Student-Oriented Program
  - — Student Science Training (for high ability secondary students)
  - — Undergraduate Research Participation (for undergraduate students)
  - — Student-Originated Studies (for undergraduate and graduate students)
- Ethnic Minorities and Women in Science
  - — Minority Institutions Science Improvement
  - — Experimental Projects and Problem Assessment

SECONDARY SCHOOL PROGRAM

The primary objective is improvement of science courses and curricula offered at the secondary school level to give high school students the best possible foundation for science- or technology-related careers. There are two main lines of attack.

Materials and Instruction Development

This activity provides support for major course development and curriculum improvement projects of national import which will produce entire course packages or modules which can be flexibly fitted into existing or new courses. The package includes, in addition to the basic text, auxiliary materials such as laboratory exercises and investigations, teacher education packages, and supplementary audio-visual materials. The objective is to enhance the capability of the educational system to interact with learners in ways that will maximize educational benefits. Appropriate kinds of activities include, but are not limited to, generation of guidelines for curricula through conferences and seminars, analysis of curriculum materials, development of resource centers for teachers, and research into the learning process.

Proposals may be submitted at any time. Prospective proposers are required to describe their projects in a preliminary proposal so that the Foundation can determine whether a formal proposal can be considered. For proposal submission guidelines, request brochure MATERIALS AND INSTRUCTION DEVELOPMENT, PRE-COLLEGE (E-74-3).

Instructional Improvement Implementation

Activities associated with improving classroom instruction will be directed toward the implementation of new course materials in the classroom. Although projects will be supported which resemble in format some of the teacher training activities supported in the past, their emphasis and structure will be substantially different. There will be opportunities to combine these formats in new ways and to develop new approaches for implementing science education improvements. Attention will be focused on working with key individuals, and with groups of schools and school systems.

All activities, including in-service teacher education, will be directed toward fostering successful implementation of major curriculum and course developments in school systems. Attention will generally be given to new approaches developed with Foundation support. However, assistance will be provided for implementation of educational programs developed through non-NSF-supported activities when thorough, comprehensive evaluations support their effectiveness. The decision to support an implementation project will be governed, primarily, by the quality of the material and by its demonstrated potential for gaining wide acceptance. Other criteria will also be applied in assessing the merits of the proposed implementation plans, including the extent of commitments of schools and associated institutions, the appropriateness of the instructional staff, cost effectiveness of operating plan to achieve desired results, etc.

Each proposal will be expected to designate those aspects of the implementation process which are its primary concern. These might include familiarization with alternative curricula or approaches; exploration in depth of a selected curriculum for committed users; training of resource teams for long-term dissemination and maintenance; installation in a significant segment of a school system; or some other formulation of an implementation scheme most appropriate for a given local situation.

Deadlines

The deadline for submission of proposals is mid-October. For proposal submission guidelines, request brochure INSTRUCTIONAL IMPROVEMENT IMPLEMENTATION (E-74-4).

Additional Information

Communications may be addressed to: Division of Pre-College Education in Science, National Science Foundation, Washington, D.C. 20550.

ALTERNATIVES IN HIGHER EDUCATION PROGRAM

In order to encourage and facilitate change in higher education to meet changing requirements for academic training, this program will support the creation and testing of alternative undergraduate and graduate programs in science and technology that will provide the professional skills needed in today's society, and will assist in the development of new modes of delivering education and the exploration of economical alternatives for introducing new program options into the existing system of higher education. AHE represents a major Foundation effort focusing on the development of quality science education that will give students greater flexibility and a broader range of career choices than former programs that were largely single-discipline oriented. This activity is designed to test alternatives to meet these needs and will pursue six separately identified approaches.

Development of Instructional Materials and Modes

One of the major avenues for the improvement of higher education in science in the past has been the development of curricular materials for use in a traditional lecture-recitation-laboratory format. NSF priorities are now shifting toward newly emerging, interdisciplinary, problem-relevant subject areas, and toward the search for more effective and efficient modes of delivery. Thus, the focus of this element of AHE will be on the creation of modules, courses, curricula, or instructional sequences in newly significant science- or engineering-based problem areas, and on studies of novel delivery systems for both on-campus and off-campus instruction.

There is considerable flexibility in project format or topic, including experimentation with alternative instructional modes, with new materials aimed at development of problem-solving competencies, with applications of modularization and self-pacing, and with independent study. Only those projects that demonstrate the likelihood of use on a national scale will be supported. Preliminary proposals are required.

Science and Engineering Technician Program

The principal objective is to stimulate the development, demonstration, and evaluation of a limited number of 2- and 4-year collegiate-level programs which provide technical personnel with a sound scientific and technical basis for continuing professional growth throughout life, an ability to adapt to future technological advances, and job entry skills for productive employment in scientific and engineering activities. Priority will be given to projects which emphasize the basic core of scientific and mathematical principles underlying technical applications and various combinations of carefully selected specialized subject areas which are responsive to recognized, national manpower requirements for technical support personnel. To minimize duplication of effort, existing or pending basic science core materials will be modified and used whenever available. All program and materials will be developed in flexible formats that assure ease of adoption by the various institutions engaged in technical education and will incorporate, whenever possible, actual or simulated practice of the technical specialty.

Alternative Degree Programs

Support will be provided to colleges and universities for design and implementation of curriculum prototypes that, as alternatives to typical basic science research-oriented baccalaureate, master's or Ph.D. degrees, lead to a wider variety of career options in areas of recognized national need. Institutions may propose entirely new undergraduate or graduate degrees or the restructuring of existing degree programs. In either case, a significant element of experimentation must be present, resulting in a meaningful departure from traditional degree programs.

College Faculty Workshops

The focus of College Faculty Workshops will be on the creation of modules, monographs, courses, curricula, or instructional sequences in newly significant science or engineering areas. The project format is the development of these instructional materials and modes with the aid of practicing college faculty. College faculty will be invited to contribute their talents as teachers and their knowledge of the requirements and capabilities of students in working with research scholars to create and test curricular materials for undergraduate students of science.

Faculty Research Participation

Research laboratories of industrial organizations, independent research laboratories or institutes, and laboratories maintained by Government agencies or universities will provide opportunities for university faculty to participate in ongoing research on problems of national interest and concern. This pragmatic experience is to assist science faculty in determining subject matter requirements of courses of instruction preparing students for careers in science.

Instructional Scientific Equipment

Partial support for the acquisition of scientific equipment will be provided for the implementation of a new or improved undergraduate instructional program in one or more of the sciences. Proposals should describe the improvement relative to the present course(s) or curriculum, its suitability for the target group of students, and the role of the new equipment in the improvement project.

Deadlines

Request brochure number E-74-5 for guidelines for the submission of proposals for Development of Instructional Materials and Modes, and Alternative Degree Programs; brochure number E-74-6 for College Faculty Workshops; and brochure number E-74-18 for Science and Engineering Technician Education Programs. Proposals may be submitted at any time in the above four programs.

Request brochure number E-74-17 for guidelines for the submission of proposals for Faculty Research Participation and brochure number E-74-15 for the Instructional Scientific Equipment Program. Deadline for receipt of proposals under these two programs is February 15, 1974.

Additional Information

Communications may be addressed to: Division of Higher Education in Science, National Science Foundation, Washington, D.C. 20550.

CONTINUING EDUCATION FOR SCIENTISTS AND ENGINEERS PROGRAM

The objective is to find effective ways to continue the professional education of scientists and engineers in the nonacademic labor force. With the steadily increasing rate of accumulation of scientific and technical knowledge has come an increasing rate of obsolescence, at great economic and social cost to employers, employees, and the Nation. Economically feasible means must be found to afford to the scientist and engineer in the labor force opportunities to keep up-to-date and to do it in a cost-effective manner. Development of appropriate subject matter and delivery systems which give promise of increasing the availability, utility, and effectiveness of continuing education will be supported, although the principal focus is on experimental projects rather than on the support of proven mechanisms.

Deadlines

Proposals may be submitted at any time. Request brochure number E-74-5, ALTERNATIVES IN HIGHER EDUCATION, for guidelines for the submission of proposals. (See also, Experimental Projects and Problem Assessment on page 61.)

Additional Information

Communications should be addressed to: Division of Higher Education in Science, National Science Foundation, Washington, D.C. 20550.

STUDENT-ORIENTED PROGRAM

The primary goal of the Student-Oriented Program is to increase the variety of instructional modes and of institutional patterns of instruction by demonstrating to both students and faculty the capacity of students to be motivated by independence and thus to accept greater responsibility for planning and carrying out their own learning activities.

Students learn easily and well when they feel that the need to learn is in harmony with their own self-interest and sense of what is important. A central mechanism for developing this feeling of connection between academic studies and the real world is to organize instruction around problems which a student can perceive as being significant, problems which are stated in ways which allow a young person to recognize and understand, from his own perspective, the nature and importance of those problems.

To bring the potential benefits of this mode of instruction directly to the attention of those who determine teaching patterns, the Foundation supports three types of activity directed toward achieving the primary goal stated above.

Student Science Training (SST) (for high ability secondary students)

SST will continue to support summer science programs, established by academic institutions and nonprofit laboratories, aimed at testing the aptitude of outstanding secondary school students for science by bringing them into direct contact with teachers and research scientists of recognized competence who can provide them with educational experiences in science and mathematics beyond those available in the usual high school courses.

Undergraduate Research Participation (URP) (for undergraduate students)

URP projects are aimed at providing experiences, through participation in research, that will enable undergraduate students to grow in independence, and will at the same time demonstrate the potential of this kind of activity as an adjunct to or as a replacement for traditional formal classroom instruction. Over the years, the Foundation has provided support under URP for student participation in all areas of research within the purview of the National Science Foundation. While the disciplinary areas will be unchanged, the program's focus has been reoriented and will be narrowed to those research projects that can be justified in terms of relevance to a particular national problem.

For the initial year under this narrower focus, the central themes of the program's activities will be "The Energy Problem" and "Management of Renewable Natural Resources." Proposers will be expected to indicate, concisely but clearly, the applicability of the proposed research to some facet of the problem or problems of (a) providing an increased energy supply or reducing the energy demand; or (b) optimizing the utilization and replenishment of the Nation's renewable natural resources.

Student-Originated Studies (SOS) (for undergraduate and graduate students)

The general aim of SOS is much the same as that of URP—the provision of student experience in independent, self-directed study, and demonstration of the effectiveness of such study as an adjunct to or replacement for traditional, formal course work—but the mechanism is different. In SOS, the projects are wholly student-originated and student-managed with faculty in a strictly advisory role, in contrast to URP, in which the faculty plays a guiding role and the student participates as a junior colleague. While the program has been addressed primarily to undergraduates (with some graduate students permitted in principally undergraduate groups), it will now be open also to groups of graduate students. The general requirement is that the studies be conducted by multidisciplinary groups and be concerned with problems of the physical, biological, or social environment.

Deadlines

Proposal deadline is December 7, 1973. Request brochure E-74-7, STUDENT-ORIENTED PROGRAMS, for guidelines for submission of proposals.

Additional Information

Communications may be addressed to: Office of Experimental Projects and Programs, National Science Foundation, Washington, D.C. 20550.

ETHNIC MINORITIES AND WOMEN IN SCIENCE

The objectives of EMWS are to study and test educational mechanisms and to support experimental models aimed at discovering and promoting more effective methods of increasing the flow of women and ethnic minority group members into careers in science. The program will move along two lines:

(a) support for college science improvement, to establish model operating science education programs designed to surmount the roadblocks hindering the movement of ethnic minority group members into careers in science; and

(b) support to academic institutions or education-related organizations to assist in developing a better understanding of the nature and origin of the roadblocks to science careers for women and minorities and in designing methods of overcoming these obstacles.

Minority Institutions Science Improvement

The Minority Institutions Science Improvement (MISI) program provides support for self-determined improvement projects in 2- and 4-year colleges that have historically provided educational opportunities to disadvantaged ethnic minority students and continue to do so. Institutions are expected to develop plans for a course of action that is designed to effect long-range improvement in the basic scientific strength of the institution. To qualify for Foundation support, a project will be expected to map out an acceleration of this development that can be maintained after grant termination. Facilities, equipment, methods of instruction, and curricula are some elements of focus which may be supported under this program.

In cases where two or more institutions define a common problem and find it advantageous to attempt a cooperative solution, MISI will entertain proposals prepared

jointly. Activities that lend themselves easily to cooperative efforts are curricula development, course content improvement, teaching materials, and other software development.

Experimental Projects and Problem Assessment

Support is also provided for projects concerned with improving the flow of women and minority group members into careers in science. Information regarding these activities is included in the discussion of Experimental Projects and Problem Assessment, found on page 61.

Deadlines

Proposals may be submitted at any time. Request brochure E-74-8, MINORITY INSTITUTIONS SCIENCE IMPROVEMENT, for guidelines for submission of proposals.

Additional Information

Communications may be addressed to: Division of Higher Education in Science, National Science Foundation, Washington, D.C. 20550.

Development of Science Literacy

IN DEVELOPING SCIENCE LITERACY, the goal is to increase substantially the number of persons who are able to make use of the methodology of science, as well as the results of scientific discovery, in their work and personal lives, whether or not they are engaged in scientific or technical occupations.

Historically, the major concern of the Foundation's science education programs has been for the student who had already decided, or who might decide, on a career in science. Only in more recent years has attention begun to turn in a more specific way to the needs of people who might not become scientists, engineers, or technicians. That even more attention should be given to this group has become increasingly apparent.

As our society becomes more and more technologically based, more and more people are becoming engaged in activities or in making decisions that require a scientific or technical background, and there is an increasingly wide range of jobs at all levels for which science training is highly useful, if not essential.

Concurrently, the Nation is making the benefits of more education available to more of its citizens. Our schools are now accommodating almost the entire school age population and are thus faced with an increasing diversity of talents, capabilities, and career aspirations. To meet the needs of these students, a wider variety of teaching materials must be developed which provide an assortment of approaches to the teaching-learning process. There must be available teaching materials that can be matched to the learning abilities of both the theoretically inclined student who learns readily from the printed page and the more practically oriented student who learns best from "hands-on" materials and tangible models.

The Development of Science Literacy activity is subdivided into two elements: an Elementary School Program and a Secondary School Program. The common objectives include the development and implementation of materials which:

- Offer a meaningful introduction to the fields concerned
- Are based on topics of inherent interest to children or teenagers
- Require a "hands-on" learning approach
- Serve as a sound foundation for later educational experiences
- Offer superior educational returns for little or no increase in investment
- Can be used without long-term reorientation of school personnel

These two programs, which are directed at students who may or may not choose careers in science, will operate within a format essentially the same as that of the science career-oriented Secondary School Program described under Improvement of Education for Careers in Science (see page 51.)

Deadlines

Materials and Instruction Development, Pre-College. Proposals may be submitted at any time. Preliminary proposals are required. Request E-74-3 for guidelines for the submission of proposals.

Instructional Improvement Implementation. The deadline for submission of proposals is mid-October. Request E-74-4 for guidelines for submission of proposals.

Additional Information

Communications should be addressed to: Division of Pre-College Education in Science, National Science Foundation, Washington, D.C. 20550.

Increasing Efficiency of Educational Processes

THE OBJECTIVE OF THESE activities is to improve effectiveness and efficiency in science education. Two major approaches to attaining a better balance between costs and productivity are planned. The first involves support of the application to the educational process of technological devices such as computers, TV, and films under Technological Innovation in Education. The second approach, which is supported under Educational Program Restructuring, focuses on a few major models of new approaches to the organization, management, delivery, and content of education.

TECHNOLOGICAL INNOVATION IN EDUCATION

Support is provided for the exploration and development of innovative uses of the computer and related communication technologies in education. The objectives of this program activity are pursued through three separate program elements:

- **Technology and Systems,** which provides support for research in computer technology and techniques applicable to education and for projects focused on the testing and evaluation of special systems.

- **Applications and Courseware,** which supports projects aimed at (1) the development, testing, and evaluation of applications and courseware in selected disciplines to support innovative uses of computing in instruction; (2) the development, testing, and evaluation of new instructional concepts related to computer-based education; and (3) the development of mechanisms to disseminate and facilitate the widespread use of these products and concepts.

- **Special Projects,** which provide support for efforts to explore and develop the use of modern communication technologies for effective and efficient instruction.

Deadlines

Proposals may be submitted at any time. Because extensive planning is usually involved in project development of these types, interested persons should discuss their ideas with program staff before submitting proposals. For guidelines for submission of proposals, request brochure E-74-9, TECHNOLOGICAL INNOVATION IN EDUCATION.

EDUCATION PROGRAM RESTRUCTURING

The Education Program Restructuring activities are experiments designed to lead to major changes, rather than to relatively minor modifications, in the way education is done, with the goal of improving the effectiveness and efficiency of the educational process. To this end, support will be provided to assist in the design, development, and evaluation of a few major experimental models of new approaches to the organization, management, delivery, and content of education. Emphasis will be placed on design and development for results that can be evaluated and documented. The aim is the production of generalizable and transportable results. The principal program efforts for the near future will be focused on (1) extensive revision of pre-service teacher education programs; (2) major restructuring of the undergraduate learning environment; and (3) statewide, regional, or urban systems projects for large-scale science education improvement at the pre-college level. More specifically, support will be provided to carry out:

- An assessment of the effectiveness of pre-service teacher education programs and the development of models through which the pre-service education of teachers can result in improvement of science education at the pre-college level.

- Experiments and demonstrations of mechanisms for effecting comprehensive changes in undergraduate learning environments.

- Experiments and demonstrations of coordinated mechanisms, involving schools, colleges, universities, and other interested institutions, to effect comprehensive changes in science curricula and in instructional modes at the pre-college level.

Proposals may provide for collaborative arrangements and funding with other universities, nonprofit and/or profit-making organizations.

Deadlines

Proposals may be submitted at any time. Because extensive planning is usually involved in project development of these types, interested persons should discuss their ideas with program staff before submitting proposals. For guidelines for submission of proposals, request brochure E-74-10, RESTRUCTURING OF EDUCATION PROGRAMS.

Additional Information

Communications may be addressed to: Office of Experimental Projects and Programs, National Science Foundation, Washington, D.C. 20550.

Experimental Projects and Problem Assessment

To increase the effectiveness and impact of NSF programs and others directed toward the improvement of science education, research and problem assessment activities will be concerned with a variety of studies—some NSF initiated and some based on unsolicited proposals—and with the support of experimental projects designed to provide understanding of the problems connected with the effective dissemination of information about new educational developments and the barriers to acceptance and implementation of these developments.

Plans for several studies have been formulated by NSF staff. Studies currently being planned include:

- Investigation of barriers to implementation of newly developed teaching materials and modes of instruction at the pre-college and post-secondary levels, and of ways to overcome them.
- Studies and experimentation to identify effective means of moving new knowledge from the research community into the educational system.
- Studies of the current state and effectiveness of continuing education for scientists and engineers.
- Studies of barriers to the movement of ethnic minority group members into careers in science and technology.

Those who may be interested in conducting one or more of the above studies are invited to send a postcard (a separate card for each study) expressing that interest.

Proposals for field-initiated experimental projects directed toward the solution of proposer-identified problems in science education, as well as proposals for projects designed to test mechanisms to accomplish the three following staff-identified missions, are invited:

- Increasing the availability of Student Science Training-type (see page 55) activity as part of the high school curriculum.
- Increasing the flow of ethnic minority students into careers in science.
- Increasing the flow of women into careers in science.

Specific details of the above three experimental project areas have been developed by the staff and will be mailed in response to postcard requests which identify the project area for which further information is desired.

Postcards expressing interest in the above studies and experimental projects should be addressed to the address listed below. For general information about field-initiated studies and experimental projects, request brochure E-74-11, Experimental Projects.

Additional Information

Communications should be addressed to: Office of Experimental Projects and Programs, National Science Foundation, Washington, D.C. 20550.

Graduate Student Support

THE PRIMARY OBJECTIVE OF the Foundation's Graduate Student Support Program is to assure that the Nation's most talented graduate students in the sciences obtain the education necessary to become a cadre of first-line researchers needed by our technologically based society.

GRADUATE FELLOWSHIPS

It is expected that in fiscal year 1974 the nationally competitive Graduate Fellowship Program will provide approximately 500 new 3-year fellowships, to be awarded to beginning graduate students. In addition, approximately 1,000 prior-year awardees will be supported. The competition is open only to citizens or nationals of the United States. For the program announcement (E-74-12) write to:

Fellowship Office
National Research Council
2101 Constitution Avenue, N.W.
Washington, D.C. 20418

The deadline for this program is November 26, 1973.

NATO FELLOWSHIPS IN SCIENCE

In cooperation with the Department of State, the Foundation administers two fellowship programs for the North Atlantic Treaty Organization (NATO). For a description of the NATO Postdoctoral Fellowship in Science, request brochure E-74-13. For a description of the NATO Senior Fellowship in Science, request brochure E-74-14.

Additional Information

Communications should be addressed to: Division of Higher Education in Science, National Science Foundation, Washington, D.C. 20550.

VII. COMPUTING ACTIVITIES

The Office of Computing Activities (OCA) was established in the Foundation in July 1967, to provide Federal leadership in exploring and developing computer technology and the uses of the computer. OCA administers programs directed at supporting basic research in computer science and engineering; research leading to advanced computer-based research techniques, systems, software and network activities; and investigations related to the use of computers in society.

OCA is a component of the Research Directorate.

Computer Science and Engineering Programs

THE NATIONAL SCIENCE FOUNDATION awards grants to support research in the computer science and engineering areas. The primary objective is to stimulate the creation of the scientific base of computer development.

The areas of research supported through the three programs within Computer Science and Engineering are indicated below. Projects may contain elements considered within several programs or deal with topics not explicitly mentioned here. The primary focus of the research will determine which program will consider the proposal.

Theoretical Computer Science Program—This program supports basic research in the theory of computation, numerical analysis and computational mathematics, theory of formal languages, intelligent systems, and other topics concerned with the theoretical foundations of computer science.

Software and Programming Systems Program—Awards in this program support basic and applied research on software and systems of programs including operating systems, computer languages and their processors, information structures and file management, man-machine interaction, graphics, and the study of algorithms.

Computer Systems Design Program—Grants for basic and applied research focusing on the development of principles of computer systems design include computer system architecture, computer system performance, major subsystems, and logic design.

Eligibility

Guidelines on eligibility and proposal preparation and other helpful suggestions are contained in the NSF brochures GRANTS FOR COMPUTING ACTIVITIES and GRANTS FOR SCIENTIFIC RESEARCH which may be obtained from the Foundation.

Deadlines

Proposals may be submitted at any time.

Additional Information

Communications may be addressed to: Office of Computing Activities, National Science Foundation, Washington, D.C. 20550.

Computer Applications in Research Programs

THE NATIONAL SCIENCE FOUNDATION awards grants to support research applications of computers and computer-based systems in science research. The potential usefulness of computers in research has increased markedly with advances in technology which, for example, make possible a high degree of interaction between the researcher and the computer via remotely located terminals, enable computers to be used on-line in complex experimental research activities, and permit the use of sophisticated computer communication networks for resource sharing. Projects in Computer Applications in Research focus on the exploitation of these and other advances in computer technology in achieving a closer coupling of computers and research.

Networking for Science Program—NSF awards in this program include research, exploratory activities, and special studies to develop the resource-sharing potential of computer networking for science research and education. This program is coordinated with related activities of the Office of Science Information Service. Special attention will be given to collaborative efforts for development of innovative and effective approaches to resource sharing. Issues and considerations include specialized resources user functions, organization aspects, economic implications, network technology and evaluative activities. A more complete description and guidelines for proposal preparation are contained in the NSF brochure EXPANDED RESEARCH PROGRAM RELATIVE TO A NATIONAL SCIENCE COMPUTER NETWORK.

Techniques and Systems Program—Awards are made in this program for projects to transfer advances in computer science into new computer-based methodology for research. Projects include advances in interactive techniques, on-line and real-time systems, hierarchical computing, and other applications of recent developments in computer and communication technology. Proposals are examined critically in this program to assess the potential contribution of the proposed work to research in the intended area of application.

Software Quality Research Program—Research and developmental activities are supported which are directed at providing researchers with accurate, consistent, well-documented and extensively tested software. Strong emphasis is placed on considerations of software analysis, robustness, performance, validation, and related topics. Projects range, for example, from research in numerical analysis techniques used in programs to program testing methodology. In addition, special encouragement is given to projects to develop improved approaches to portability, availability, and distribution of computer software applicable to research.

Eligibility

Guidelines of eligibility and proposal preparation and other helpful suggestions are contained in the NSF brochures GRANTS FOR COMPUTING ACTIVITIES and EXPANDED RESEARCH PROGRAM RELATIVE TO A NATIONAL SCIENCE COMPUTER NETWORK, which may be obtained from the Foundation.

While universities can be expected to be the primary recipients of support in the above-named programs, industry and other organizations are eligible for support. Unsolicited proposals will be accepted from any source, subject to cost-sharing requirements. Proposals will be solicited as necessary in certain areas. Awards resulting from solicited proposals may provide full costs, with cost-sharing or fees negotiated as appropriate.

Deadlines

There are no deadlines for proposals submitted to these programs.

Additional Information

Communications should be addressed to: Office of Computing Activities, National Science Foundation, Washington, D.C. 20550.

Special Projects

THE NATIONAL SCIENCE FOUNDATION awards grants for research projects, studies, workshops, and other activities which encourage the development of new fields of computer science research that are responsive to the problems and opportunities arising from the widespread use of the computer in the service of society. Basic research topics supported by this program include, but are not limited to, technical questions of privacy in computer systems, human/machine interface, the state of computer science research, and the concepts underlying computer simulation and conferencing.

Eligibility

Guidelines on eligibility and proposal preparation and other helpful suggestions are contained in the NSF brochures GRANTS FOR COMPUTING ACTIVITIES and GRANTS FOR SCIENTIFIC RESEARCH, which may be obtained from the Foundation.

While universities can be expected to be the primary recipients of support in the above-named program, industry and other organizations are eligible for support. Unsolicited proposals will be accepted from any source, subject to cost-sharing requirements. Proposals will be solicited as necessary in certain areas. Awards resulting from solicited proposals may provide full costs, with cost-sharing or fees negotiated as appropriate.

Deadlines

Proposals may be submitted at any time.

Additional Information

Communications may be addressed to: Office of Computing Activities, National Science Foundation, Washington, D.C. 20550.

VIII. SPECIAL PROGRAMS

Science and Technology Policy Office

ON 1 JULY 1973 the Director, NSF, was assigned the additional responsibilities of Science Adviser to the President. To provide staff assistance to the Director in the performance of these duties, the Science and Technology Policy Office (STPO) was organized.

The STPO provides assistance to the Director by:

Providing advice, consultation and recommendations on national civilian science and technology policy.

Developing technical options related to the solution of national problems in the civilian area.

Appraising the overall effectiveness of ongoing Federal and national R&D efforts and recommending policy and program action toward the achievement of national goals through civilian science and technology.

Serving as the focal point for coordinating Federal R&D programs (STPO will provide staff support for the FCST and assist the Director in the formulation and coordination of FCST activities).

Interacting with academic and industrial science communities on broad matters of science policy so as to further their participation, in every appropriate way, in strengthening science and technology in the United States.

Providing advice and assistance in furthering U.S. international science and technical objectives.

To expand the effectiveness of the staff, the STPO will be soliciting proposals for studies and grants in the following major areas:

International Science and Technology

Modeling and Forecasting Techniques

University Science Policy Groups

Problem-oriented Policy Studies

Intergovernmental Science and the Role of Federal Technology Sharing Programs

Evaluation of Selected Federal programs

Additional Information

Communications should be addressed to: Science and Technology Policy Office, National Science Foundation, Washington, D.C. 20550.

National Energy R&D Assessment Program

THE PRIMARY PURPOSE OF this program is to provide to the Director, in support of his role as Science Adviser to the President, an independent source of advice and analysis of energy R&D and other energy-related programs for use by the Executive Office of the President—in particular, the new Energy Policy Office and the Office of Management and Budget.

The program is designed to assist the Director in the performance of the following functions:

- Providing analysis of specific issues and selected programs related to energy R&D, including energy supply technologies, energy demand and conservation, and energy-related areas of environmental, economic, and sociological research.
- Developing a general systems framework for the evaluation of energy R&D programs, and developing appropriate criteria for assessing the merits of individual technological approaches.
- Identifying and recommending to the Executive Office of the President critical needs in energy R&D.
- Providing independent assessment of environmental, health, and safety standards, and identifying necessary additional research to improve standard setting.
- Maintaining awareness of current plans and viewpoints of industry and associations on matters related to energy R&D.
- Determining ways in which universities and other research organizations can make their most effective contribution to energy R&D from a research and manpower viewpoint.

The program will utilize existing data and research sponsored by other agencies and other NSF programs to the maximum extent feasible. New research will be conducted and supported, however, to meet the objectives of the program.

Eligibility

The work of this new program will be performed by a group of analysts responsible to the Office of the Director, and through grants and contracts with universities and other appropriate organizations.

Study proposals which are supportive of the program plans will be considered for awards. The program of studies will be a cooperative effort involving the analytical staff at the Foundation and a limited number of extramural grants and contracts. It should be noted that this program does not fund efforts to undertake energy R&D. Rather, its responsibilities are associated with the determination of what types of energy R&D should be undertaken.

Deadlines

Proposals may be submitted at any time during the year. Approximately 3 to 6 months should be allowed for review and decision.

Additional Information

Communications should be addressed to: Office of Energy R&D Policy, National Science Foundation, Washington, D.C. 20550.

Experimental Research and Development Incentives

THE NATIONAL SCIENCE FOUNDATION supports a program designed to provide experimental evidence concerning various incentives which the Federal Government might use to increase the application and use of science and technology in the civil sector. The objectives of the program are:

- Identify institutional barriers to innovation
- Test appropriate Federal action which might reduce such barriers.

The program will provide a focus in the Federal structure for testing various means of accelerating the rate of technological innovation in the private and public sectors of the economy. The program will support background studies to identify and understand barriers and blockages to the technical innovation process in selected areas of application, and experiments designed to investigate incentives intended to overcome these blockages. Each experiment will support tests of the effect of a specific incentive mechanism on a barrier or set of barriers which inhibit the innovative process.

Areas of current program interest include:

- Testing and validation by Federal laboratories and approved private testing laboratories of new products that significantly extend the current state-of-the-art and which have their primary market in the public sector, i.e., municipal, city, county, State, and regional governmental public services. (A similar program in fiscal year 1973 for testing and validation of products having their primary market in the private civil sector has been discontinued.)

- Cooperative R&D activities between colleges and universities on the one hand and industries, industrial associations, professional societies, profit and nonprofit R&D institutions, Federal laboratories, or State and local governmental entities on the other hand. The cooperative R&D proposal may include two cooperating institutions or multi-institutional arrangements. The proposed research activity should be for product, process, or service development of primary interest to the nonacademic institutions and in which one or more academic departments have a parallel or collateral interest.

- Urban and public sector technology transfer mechanisms that involve and explore improving the effectiveness of the roles of:

  — Universities
  — Public service institutions
  — Non-Federal governmental jurisdictions
  — Research institutes
  — Corporations and Federal laboratories

- Institutions interested in this area may submit proposals alone or jointly to support projects to test the effectiveness of incentives and technology transfer mechanisms to improve and accelerate the application of technology (products, processes, or service systems) to needs in the public service sector of the economy.

- Start-up problems for delivering new technological products, processes, and services to market utilization in the private or public sector. Proposals will be received for experimental activities to test incentives and mechanisms for their application that would reduce barriers to the start-up problems involved in small R&D company products and in bringing new products to medium-sized and larger company product lines.

Before submitting a proposal for support, descriptive brochures on the program should be consulted and if possible, contact be made with program staff. From time to time, specific program announcements will be issued detailing the Experimental R&D Incentives Program interest in given incentive and barrier areas. These announcements will describe the areas and the procurement arrangements to be made, whether by

unsolicited grant award, or by general or specific area solicitation, for contract procurement. As the program advances, a larger proportion of competitive contract procurement procedures will be employed, but it is expected that unsolicited proposals will continue to be utilized as sources of ideas which may be funded as grants for general background, state of art, and summary of knowledge studies and for some experiment concept and early definition awards. The award mechanism for major projects and experiments will be by contract procurement procedures.

Eligibility

Proposals may be submitted by colleges and universities; industrial or trade associations; industrial organizations; and public service institutions, research institutions, and nonprofit organizations, including State and local governments. These proposals may provide for collaborative arrangements with other universities, nonprofit, and/or profit-making organizations. Such arrangements are not mandatory.

Deadlines

Proposals may be submitted at any time. Approximately 3 to 6 months are required for consideration of proposals.

Cost Sharing

Cost-sharing on unsolicited research proposals is required by statute. Organizations proposing to participate in this program will be expected to demonstrate their commitment by agreement to cost-share on a basis commensurate with the potential financial benefit to themselves. The standard cost-sharing arrangements made with colleges and universities by the Foundation in its other program areas will also apply to the grant awards made to these institutions under the auspices of this program. Grants made to profit-making institutions will have cost-sharing provisions negotiated as appropriate to the potential financial benefit of the participants. Contract awards may provide for full costs. Cost-sharing or fees may be negotiated as appropriate.

Additional Information

Communications should be addressed to: Office of Experimental R&D Incentives, National Science Foundation, Washington, D.C. 20550.

National R&D Assessment Program

THE PRIMARY PURPOSE OF this program is to provide an analytical capability, consonant with the expressed needs of Congress and the Executive Office of the President, for objective study and assessment of how science and technology contribute to the achievement of national goals and objectives. Through this program, the National Science Foundation analyzes patterns of R&D/technological innovation, the incentives and decisions that underlie the existing patterns, and the implications that our choice of options has in shaping future patterns of R&D/technological innovation.

The program is designed to achieve a fuller understanding of:

- Relationships between Government policy options and R&D/technological innovation;
- Socioeconomic effects of R&D/technological innovation (e.g., productivity, employment, income, foreign trade, and individual well-being);
- Processes of technological innovation.

The program will utilize existing data and research sponsored by other agencies and other NSF programs to the maximum extent feasible. New research will be conducted and supported, however, to meet the objectives of the program.

Eligibility

The work of this new program will be performed by a group of analysts, responsible to the Office of the Director and reporting to the Deputy Director, and through grants and contracts with universities and other appropriate organizations.

Study proposals which are supportive of the program plans will be considered for awards. The program of studies will be a cooperative effort involving the analytical staff at the Foundation and a limited number of extramural grants and contracts (about 20 per year).

Profit-making and other organizations are eligible to participate in the National R&D Assessment program on the same basis as academic and nonprofit organizations. A profit-making organization does not have to meet any special requirements before its proposals can be accepted for consideration and such proposals will be evaluated on the same basis and by the same criteria as other proposals.

Deadlines

Proposals may be submitted at any time during the year. Approximately 3 to 6 months should be allowed for review and decision.

Additional Information

Detailed program plans and more detailed criteria for proposal preparation and submission are available from the Office of National R&D Assessment, National Science Foundation, Washington, D.C. 20550.

Research Management Improvement Program

THE NATIONAL SCIENCE FOUNDATION awards grants for support of projects directed to the improved management of federally supported research activities and resources at universities, colleges, and other nonprofit research institutions.

The objective of the program is to enhance the effectiveness of federally sponsored research by enabling institutions with substantial Federal research support to manage their research programs better. A more complete program description and guidelines for proposal preparation are contained in the brochure RESEARCH MANAGEMENT IMPROVEMENT PROGRAM ANNOUNCEMENT.

Eligibility

Universities, colleges, independent nonprofit research institutions, and groups of these organizations are eligible for support. However, institutions or consortia receiving less than $1 million annually in Federal research support may be at a disadvantage in competing for support.

Deadlines

Deadlines in fiscal year 1974 are August 31, 1973, December 31, 1973, and June 30, 1974.

Additional Information

Inquiries, preliminary proposals, and other communications should be addressed to: Research Management Improvement Program, National Science Foundation, Washington, D.C. 20550.

This program is administered by the Directorate for National and International Programs.

Ethical and Human Value Implications of Science Program

THE ETHICAL AND HUMAN Value Implications of Science Program was established in February 1973 to consider new approaches to questions involving the ethical and human value implications of science and technology. Scientists are often aware of potential use or misuse of new knowledge before nonscientists, and the purpose of the program is to surface these insights and illuminate ethical and human value issues at an early stage. This area is related to both technology assessment and environmental impact, as well as to ethics, philosophy of science, and law, but it is more specialized than any of these in its sharper focus on cultural and humanistic values as they are challenged, modified, or influenced by advances in science and technology. In so doing, the new program will address such essential but largely unquantifiable values as privacy, freedom, scenic beauty, the civilized amenities, and the sanctity of life.

Although the National Endowment for the Humanities (NEH) and the National Science Foundation have in the past supported activities related to this subject, both foundations—individually and in collaboration—are now prepared, on a selective and limited basis, to support scholarly activities in this field. Such approaches may include research and educational development, together with conferences, colloquia, seminars, and similar activities.

The NSF and the NEH have established procedures which will enable them to work in close collaboration in this program. Proposals for research or other activities in this field may be submitted either to the NSF or NEH, depending on their primary orientation. If the subject of inquiry falls within the physical or social sciences or some branch of technology, or if the approach to be used is primarily scientific, the proposal would be more appropriate for NSF. If the subject of inquiry is primarily humanistic or if the approach is primarily philosophical or historical, the proposal would be more appropriate for NEH. To some extent, the disciplines of the investigators and the relative presence or absence of quantitative factors may also serve as a guide. Through coordination between the two foundations, proposals may be transferred from one to the other as indicated by the subject matter, availability of funds, etc. In appropriate instances, there may be joint funding of approved proposals.

Eligibility

Universities, colleges, and nonprofit organizations may submit proposals for consideration. However, in this program, pre-submission discussion with appropriate staff of either foundation is considered desirable.

Deadlines

Proposals may be submitted at any time; however, processing of proposals usually requires 4 to 8 months.

Additional Information

Proposers should consult NSF Important Notice No. 48, and appropriate NSF brochures such as GRANTS FOR SCIENTIFIC RESEARCH, GRANTS FOR EDUCATION IN SCIENCE, and/or RESEARCH APPLIED TO NATIONAL NEEDS GUIDELINES.

Institutional Grants for Science Program

THE NATIONAL SCIENCE FOUNDATION awards grants for broad institutional use to colleges and universities, based on Federal research awards from any one of the Federal departments or agencies reporting obligations to the Committee on Academic Science and Engineering. These are flexible funds for use at the discretion of the institution to strengthen and balance science programs of research and education. The funds may not be used for indirect costs.

The grants are computed by a graduated formula based on Federal research awards received by the institution during the previous fiscal year.

Eligibility

Institutions eligible to apply for grants under the Institutional Grants for Science Program are colleges and universities receiving Federal research awards, excluding those of the Public Health Service, during the previous fiscal year (July 1—June 30). Grants made by the Foundation through its programs of Undergraduate Research Participation, and Student-Originated Studies also establish eligibility for Institutional Grants and are included in the base for their computation.

Deadlines

Announcements are available in May of each year from the address listed below. The application deadline is July 31. Grants are announced in December.

Additional Information

Communications should be addressed to: Institutional Grants for Science Program, National Science Foundation, Washington, D.C. 20550.

International Travel Grants

THE NATIONAL SCIENCE FOUNDATION awards international travel grants to assist scientists to go abroad for one of the following purposes:

(1) Attending international scientific congresses and meetings;

(2) Obtaining or exchanging information in the areas of basic research, science education, science information or information relating to international scientific programs and associated activities;

(3) Cooperating in international scientific activities.

International travel is defined as all travel outside the United States and its possessions, Canada, and Puerto Rico.

NSF each year selects certain meetings, in areas of particular interest to the Foundation, for which participant support may be granted.

International travel grants made to individuals are based on, and normally limited to, the equivalent cost of jet-economy air transportation from the city where the traveler resides, or is employed, to his destination abroad and return. A per diem may be paid when an individual is traveling as a representative of the U.S. Government, an international organization, or a U.S. scientific organization functioning as a national member of an international organization. Travel must be by U.S. flag carriers, except in special circumstances.

Eligibility

Requests for international travel grants may be submitted by individual U.S. scientists or by nonprofit organizations (usually professional societies). When a request is submitted by an individual U.S. scientist, NSF form 192, Application for International Travel Grant, available from the Foundation, should be used.

Deadlines

Approximately 2 months are required to process requests, but those for travel to meetings should be submitted 4 months in advance because evaluation of requests normally occurs several months before the meeting date.

Additional Information

Communications may be addressed to the appropriate office: Division of Biological and Medical Sciences; Division of Engineering; Division of Environmental Sciences; Division of Mathematical and Physical Sciences; Division of Social Sciences; Division of Materials Research; Office of Science Information Service; Office of International Programs; Office of Computing Activities; Office for the International Decade of Ocean Exploration; Office of Polar Programs; Division of Higher Education in Science; or Research Applications Directorate; National Science Foundation, Washington, D.C. 20550.

Scientific Conference Grants

THE NATIONAL SCIENCE FOUNDATION awards grants to support conferences, symposia, and workshops held in the United States that bring together leading scientists who are pioneering in new or incompletely explored fields of science.

The Foundation does not provide support for regular meetings of scientific societies. Support for special conferences should be requested only if regular meetings of professional societies do not provide the necessary forum.

Eligibility

Proposals for support for scientific conferences may be submitted by U.S. colleges and universities, nonprofit research institutions, or scientific or professional societies. Concomitant support by several Federal agencies or private organizations is permissible.

Deadlines

Proposals for Scientific Conference Grants may be submitted at any time, but at least 6 months before the projected conference date.

Additional Information

Communications may be addressed to the following divisions or offices as appropriate: Division of Biological and Medical Sciences; Division of Engineering; Division of Environmental Sciences; Division of Mathematical and Physical Sciences; Division of Social Sciences; Division of Materials Research; Office of Computing Activities; Office of Science Information Service; Office for the International Decade of Ocean Exploration; Office of Polar Programs; Office of International Programs; or Research Applications Directorate; National Science Foundation, Washington, D.C. 20550.

Special Foreign Currency Programs

THE NATIONAL SCIENCE FOUNDATION makes awards to support scientific activities overseas which will incur costs payable in the currencies of Burma, Egypt, Guinea, India, Pakistan, Poland, and Tunisia. These awards are in two categories: grants for research, science education, and related activities; and contracts for procurement of scientific and technological information. They utilize foreign currencies which the Treasury Department has determined to be in excess of the established requirements of the United States.

Research, Science Education, and Related Activities—Three main classes of activity are included in this program: cooperative research and science education projects, international travel, and visiting scientist activities. A principal purpose of the program is to promote the establishment of enduring collaborative relationships between scientists and institutions of the United States and participating countries.

The Foundation brochure NSF SPECIAL FOREIGN CURRENCY PROGRAM, SUPPORT FOR RESEARCH, SCIENCE EDUCATION, AND RELATED ACTIVITIES, INFORMATION FOR U.S. SCIENTISTS describes the classes of activity supported and provides other information. A companion publication, subtitled INFORMATION FOR SCIENTISTS IN PARTICIPATING COUNTRIES, is also available. The program provides necessary supplemental dollar support to U.S. institutions for activities which directly enhance the benefits of U.S. participation; requests for principal dollar support by U.S. institutions may be included in proposals for consideration by other program offices of NSF.

Foreign Science Information Program—In fulfilling its responsibility for coordinating the needs of U.S. Government agencies, the Foundation contracts with organizations in participating countries (including Israel) for delivery of scientific and technological information to the United States. Contracts cover translating, abstracting, indexing, reviewing, and publishing in English of significant foreign scientific literature. The preparation and publication of surveys, directories, guides, and other reference aids on foreign scientific and technical information resources—literature, institutions, scientists—is also undertaken under contract.

The following sections on eligibility and deadlines refer only to **Research, Science Education, and Related Activities.**

Eligibility

Organizations eligible to submit project proposals are nonprofit higher educational institutions, scientific institutes, scientific and technical societies, and similar organizations, chartered to conduct business in the United States or the participating country. Scientists affiliated with such organizations may apply for support for international travel or visiting scientist activities.

Agreement on the objectives, content, and scope of a cooperative project should be reached by U.S. and foreign scientists before they submit proposals. Consultation or correspondence with the Office of International Programs by prospective U.S. or foreign proposers prior to submission of a formal proposal is recommended. Formal proposals should be prepared in accordance with the requirements outlined in the relevant NSF brochures. Project proposals to be funded in foreign currency must be approved by the government of the participating country; the scientific institution in that country which is co-sponsor of the project initiates the request for approval.

Deadlines

Proposals for activities to be funded by foreign currency may be submitted at any time. Approximately 6 months are required to consider a project or visiting scientist proposal; 3 months are required to consider a proposal for an international travel grant.

Additional Information

Communications should be addressed to: Special Foreign Currency Section, Office of International Programs, National Science Foundation, Washington, D.C. 20550.

Requests for information about the availability of materials produced under the Foreign Science Information Program should be addressed to National Technical Information Service, U.S. Department of Commerce, Springfield, Va. 22151.

This program is managed by the Directorate for National and International Programs.

Science Information Service

THE NATIONAL SCIENCE FOUNDATION awards grants and contracts to improve the dissemination of scientific information. Foundation support may be provided for the following activities:

(1) Studies of the economics of information transfer.

(2) Improvements in the application and use of bibliographic and quantitative data from existing systems.

(3) Development of compatibility and resource-sharing among information systems.

(4) Research in science information, including both theoretical and applied aspects.

The Foundation's brochures IMPROVING THE DISSEMINATION OF SCIENTIFIC INFORMATION and GRANTS FOR SCIENTIFIC RESEARCH should be consulted for additional information on scientific information programs and instructions for submission of proposals.

Eligibility

Institutions eligible to submit proposals are professional scientific and technical societies, universities and colleges, and profit and nonprofit organizations. Organizations that plan to submit proposals are encouraged to discuss their ideas informally with the appropriate staff members before preparing formal proposals.

Industry's capabilities for system design is important to the assembly of national operating information systems. For example, industry participation may involve design and development of general-purpose computer programs, document delivery systems, and new processes for scientific publication. Industry participation will be sought on a solicited basis, but no funds will be provided for the purchase of major capital equipment.

Deadlines

Proposals may be submitted at any time; approximately 3 months are required to consider a proposal.

PLEASE NOTE: The Office of Science Information Service is not organized for the following services:

(1) Provide bibliographic or reference services or perform literature searches.

(2) Furnish copies of publications resulting from research sponsored by NSF or other organizations.

(3) Hire translators or perform translations of any foreign publications.

Additional information

Communications may be addressed to: Office of Science Information Service, National Science Foundation, Washington, D.C. 20550.

This program is managed by the Directorate for National and International Programs.

Public Understanding of Science

THE NATIONAL SCIENCE FOUNDATION considers one of its important responsibilities to be the development of a greater public understanding of science. In addition to fostering public understanding of science as part of many grant programs, the Foundation has a special program of Public Understanding of Science seeking to bring direct focus and support to this area. Central to the purpose of this program is the enhancement of citizen knowledge and understanding of both the potentials and limitations in the use of science and technology in meeting current and emerging societal problems.

Proposals are encouraged which relate to one of the following programs, within terms of a single or combined focus.

Information Projects on Science—Proposals to be considered under this general support area should facilitate the dissemination of information on science for the general public. Examples of the types of projects which may be eligible for support are: special purpose films and television programs, science exhibits, science forums for laymen, and [illegible]rable activities.

A limited number of projects are funded which focus on either increasing the scientific knowledge of new media personnel or promoting the exchange of ideas through seminars and conferences between scientists and laymen on science policy issues of national and regional import.

National, Regional, and Community Programs—Proposals may be submitted for pilot programs in public understanding of science designed to serve either broad or specific audiences of a national, regional, community, or other discrete geographical area. Such programs will normally be multi-purpose in nature and encompass diverse means of communication. Interinstitutional arrangements are particularly encouraged on a matching funds basis.

Research and Methodological Studies—Proposals may be submitted for research or analytical studies of the communications process as it relates to public understanding of science. This category may also include the testing and evaluation of new approaches in communicating scientific information to nonscientists.

Eligibility

Institutions eligible to submit proposals are colleges, universities, and independent, profit and nonprofit organizations.

Deadlines

Proposals may be submitted at any time. Project proposals should initially be submitted informally for preliminary review. Processing of formal proposals normally requires at least 3 months.

Additional Information

THE PUBLIC UNDERSTANDING OF SCIENCE brochure describes the process of submitting proposals in more detail. Communications may be addressed to: Office of Public Understanding of Science, National Science Foundation, Washington, D.C. 20550.

This program is administered by the Office of Government and Public Programs.

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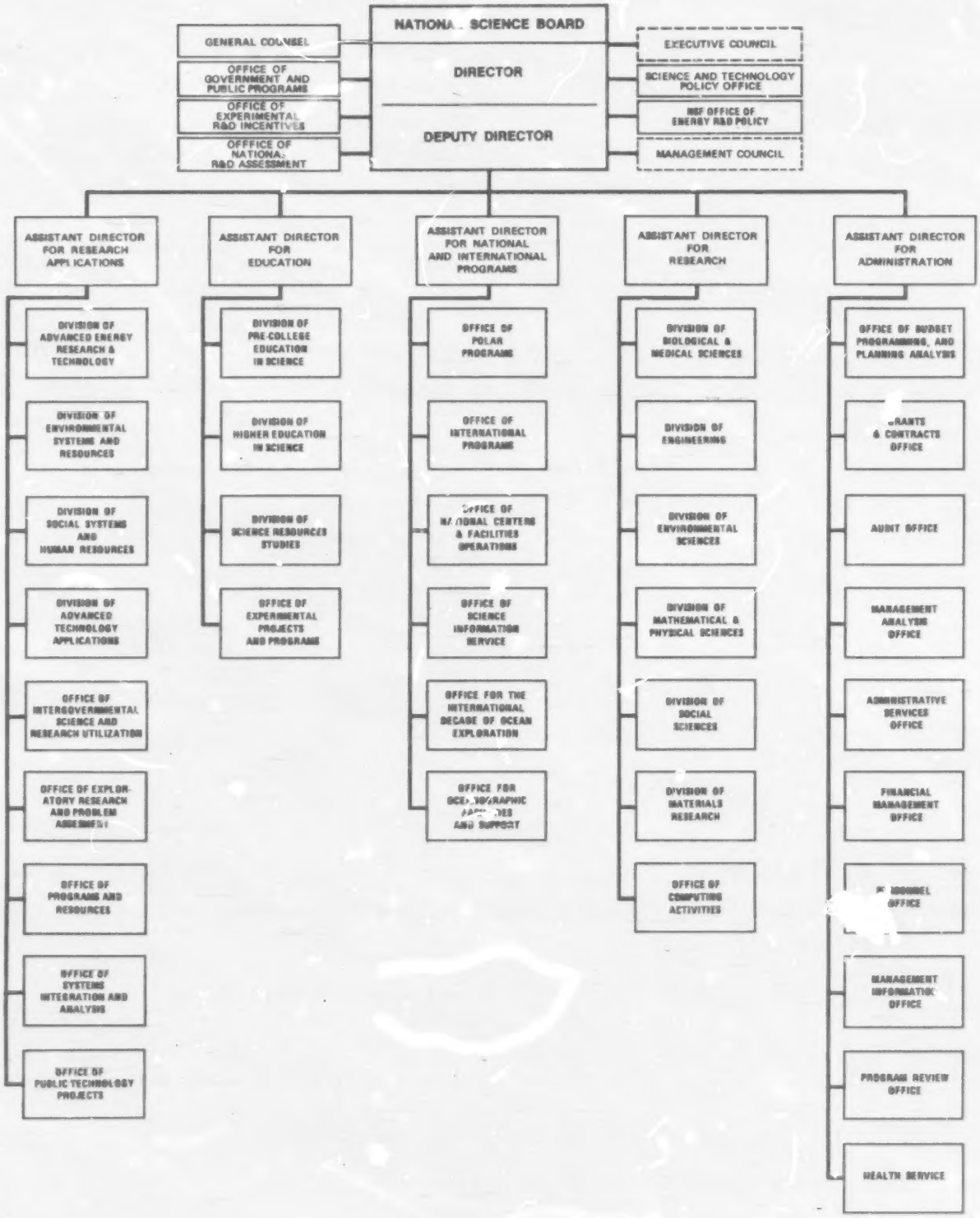
NATIONAL SCIENCE FOUNDATION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